The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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Contents

NOTICES:—All communications relating to editorial matter should be addressed to the Editor, who will be pleased to consider articles or contributions dealing with modern chemical developments or suggestions bearing upon the advancement of the chemical industry in this country. Communications relating to advertisements or general matters should be addressed to the Manager.

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A Manchester Referendum

OUR attention has been drawn by readers to the result of a referendum just taken by the Manchester Chamber of Commerce on the Safeguarding of Industries and the Dyestuffs Acts. The figures are certainly not to be ignored as reflecting the judgment of one of our most important commercial organisations. The electorate, numbering 3,787, were asked two questions:—(1) Are you in favour of the repeal of the Safeguarding of Industries Act? (2) Are you in favour of the Repeal of the Dyestuffs Act? On the first, 1,306 voted for repeal and 330 against, a majority of 976. On the second, 1,311 voted for repeal and 304 against, a majority of 1,007. On the number of votes polled, the majorities are decisive; but a feature not to be overlooked is that the total of those who abstained from voting considerably exceeded the total of those who did. In actual arithmetic, 1,636 voted for, 330 voted against, and 2,151 took no part. When, in the event of a referendum, a substantial majority of the electorate express no opinion, it seems reasonable to infer that they have no great hostility to the measures. But limited to the minority who actually voted the referendum is distinctly against both Acts.

The Board of the Manchester Chamber of Commerce, in the face of this result, adopted by 22 votes to 3 a resolution calling upon the Government to repeal these Acts at the earliest possible period because of their injurious and irritating effects. But instead of resting content with this quite logical step, they added a significant reservation—namely, that "in so far as the safeguarding of certain industries may be essential for national safety, such end can best be secured by means of subsidy." Nor does the Board's qualification stand alone. The *Manchester Guardian*, in discussing this "blow at protection" and calling upon the Government seriously to review its policy, says that the Safeguarding Act can be torn up without tears, but that, "if protection there must be for dyes, some more equitable plan must be devised." And yet, again, the "Colour User" who writes in the same journal demanding the repeal of the Dyestuffs Act, agrees with "all sensible and patriotic people" that "we must protect the industry which produces explosives and poison gases." These reservations, we think, may fairly be described as significant. Manchester is the traditional home of Free Trade. Its prosperity is largely based on successful merchanting, and its merchanting community is naturally hostile to any restrictions on free import and export. Yet in this centre of world commerce, though we are assured that the general trade of the country "has suffered and continues to suffer irreparable damage," a clear majority of the members of the Chamber of Commerce are too indifferent to record a vote. Further, hostile critics of the legislation in question do not demand its unreserved repeal and the unqualified return to a Free Trade policy; they demand a repeal subject to a very important "If," and it is on that "if" that the whole question turns. "If" the entire English textile trade is being ruined by the Dyestuffs Act, then, of course, it must go; but it might be equally appropriate to ask, "if" this is what Manchester really thinks to-day why did it reject, actually in the Exchange Division, such a champion of the repeal policy as Sir William Barton?

Hypothetical questions of this sort cut no ice. As we have pointed out more than once, the merchant who wants to buy in the cheapest markets of the world for distribution at home and overseas will never look at the dyestuffs question from the manufacturer's point of view. Nor is it at all unreasonable that he should think more about his own immediate business than about more distant national interests. But, after all, the country does not consist wholly of importers, and the difficulty is to dispense equal justice among widely different interests. There have always seemed to be one or two outstanding principles by which in this maze of conflicting claims the question might be judged. First of all, faith should be kept with those industries which were established to meet national needs on the assurance that the country would stand by them. Secondly, this country, impressed by its war

experiences, determined to establish a British dyestuffs industry, which never ought to have been allowed to pass under the control of Germany, and our view is that what Manchester did to save its ship canal Great Britain is able and prepared to do to establish a national dyestuff industry. Some temporary price must be paid, but we have no very exact evidence that the price so far is heavier than the country expected and is prepared to pay. If the administration of the Act can be improved and its working speeded up, by all means let it be done, but those who are prepared now to apply protection in the form of a subsidy are just as much deserters of the Free Trade principle as those who prefer a licensing system. If our good friends of the merchant class think that these views do not fully represent the case we shall be delighted to open our columns to them to put the position in its true light.

Industrial Mercury Poisoning

A CORRESPONDENT with whom we have recently been in touch has raised the question of industrial mercury poisoning, upon the prevention and treatment of which he is anxious to gather recent and reliable information. It has been said that there is probably no industry, trade, or art in which mercury is used which has not produced some cases of this form of poisoning, and this is particularly true of the mining and smelting of mercury. So far as our knowledge goes there is very little available literature which can be specifically recommended for study by the technical man who is anxious to introduce safeguards against this form of poisoning, for the problem has mainly been studied from the physiological standpoint, and is one which has been given attention in medical rather than in chemical literature. One cannot neglect to refer, however, to the admirable report on the matter which was issued in America by Mr. R. R. Sayers in May of last year. In this report it was pointed out that when the ore contains free mercury or the more soluble salts, and when the workings are underground and poorly ventilated, cases of poisoning are found to occur, but they are much more common amongst those employed in connection with reduction processes. The frequency and severity of the cases are far less with modern methods of mining and recovery of the metal than formerly; but there is apparently still plenty of room for the introduction of precautionary measures. The cases of industrial mercury poisoning which occur in mines and reduction works are usually chronic in form, with the occasional development of acute symptoms when the workmen are exposed to undue amounts of mercury vapours, dust, or soot. Mr. Sayers remarked in his report that insufficient or improper ventilation of the working places, together with failure to maintain sufficient back pressure to prevent the escape of mercury vapour from furnaces, condensers, and retorts, is a very important predisposing cause of the poisoning, while uncleanliness of the workmen appears to be no small factor in the production of the condition. The exciting cause of industrial mercury poisoning is the absorption and retention of small quantities of the metal or one of its many compounds over an extended period of time; but the process by which the mercury enters the body is not definitely known, although some authorities state that the mercury salts combine with the tissue to form a mercury albuminate. The preventive phase of the treatment of this form of poisoning is undoubtedly far more important than the curative phase, and if certain well-established rules are observed there is no question that comparative freedom can be ensured. The matter is not one with which industrial chemists in this country are particularly familiar; but our correspondent would be grateful for any information as to causes and prevention which those of our readers who have come in contact with the problem might be able to supply.

A Century of Progress

THE sketch, which is published in this issue, of the history of the United Alkali Co.—a sketch in which the milestones in a century of consistent progress are neatly picked out—has two noteworthy points about it. It depicts, in the first place, a triumph of private enterprise, in which science, technology, commercial organisation, and—by no means least of all—good handling of the human factor in industry have been happily co-ordinated. The Muspratt enterprise—for the impersonal title the firm has now assumed happily does not obscure its personal and family associations—ranks among the best of our national chemical achievements; one thinks of it broadly very much as one thinks of Brunner, Mond and Co., or Lever Brothers. In all three the foundations of success have been laid by able and far-seeing men, who have not only managed well the undertakings they supervised themselves, but have left an organisation for others to develop and a staff and traditions to enable them to do it. We are often taunted with the wonderful successes of German enterprise, but what has Germany or any other nation to show better than these? Moreover, their success has been achieved without any dependence on State or other extraneous aid. The opportunities were realised by the right men at the right moment and were taken advantage of in the right way. If, when Perkin produced his famous "mauve," some commercial general had similarly seized the chance of leading the world in dyestuffs, we should not be to-day laboriously struggling to do what should have been done half a century ago.

The second point is that the contribution is one of a number of essays which members of the United Alkali Co.'s own staff were invited to submit on the subject of the centenary of the firm, which is to be celebrated about the middle of April. A firm which can succeed in inspiring in its staff such a personal pride and interest in the history of the undertaking and a study of the scientific and other reasons for its success has mastered one of the most difficult arts—that of treating in the right spirit those who serve it. And in days when the tendency is towards impersonal relations between great corporations and great bodies of workmen, the old personal and family connections, as in this case, are too good to be allowed to lapse. The MS. of this particular essay is a simple but particularly neat example of hand-lettering and ornamentation, in the breviary or missal style, and, unless we are deceived, a gift of this kind might find useful exercise in the writing and design of the company's advertisement and similar matter.

A Combination Acid Plant

IN the annual review article, dealing with developments in heavy acids and alkalis, which Mr. Parrish contributed to our issue of December 30, attention was drawn to a suggested arrangement which might form a happy compromise between the ordinary contact plant for the production of oleum and the time-honoured system for the manufacture of chamber acid. This is a development which, no doubt, must prove of particular interest to our readers, for the technical and practical perfection of a plant which provides simultaneously for the manufacture of high-strength and chamber-type acid is a consummation for which many industrial chemists would be thankful. An authority on acid-making in the course of a discussion of the matter which appeared in our columns some few months ago remarked that there is a limit to the economic utility of a cascade concentration plant, a statement which applies with equal force to many other types of acid-rectifying apparatus. The wide difference in the capacity of concentration plants when producing acid of (say) 92 per cent. H_2SO_4, and acid of (say) 96 to 98 per cent. H_2SO_4 makes this amply clear; and in point of fact many works managers have reached the conclusion that cascade concentration plants, as well as Kessler and other such installations, are not suitably adapted for the production of the latter strength of acid. We are told that the procedure at many works when meeting demands for the higher strength acids is to operate the concentration plant to its economic limit, and to bring up to the desired specific gravity by adding, in a suitable mixing plant, oleum purchased from elsewhere. It is understood that a combination acid plant designed for the production of sulphuric acid of varying strengths has been tried at some works in this country, but with results which can only be described as disappointing. In his article referred to above Mr. Parrish draws attention to the view held in certain quarters that an oxide shaft of the Mannheim type combining accessory plant can be attached to an ordinary chamber system with advantage. In one instance it was proposed to treat the unconverted sulphur dioxide gases (after eliminating the acid mist and suitably preheating) which emerge from the oxide shaft in a small Glover tower with nitrous vitriol, passing the exit gases to the chamber system; while there are other reports of a combination plant which has been in satisfactory operation for some time. It would seem, in fact, that the production in a single unit of sulphuric acid of varying strengths is a problem which will not have to wait long for its solution.

Chemical Plant Exhibits

SOME preliminary notes are published in this issue on the chemical plant section which is being organised in connection with the British Industries Fair to be opened at the White City on Monday, February 19. Without being exhaustive the list of entries noted is sufficiently wide to be sure to command keen attention, and one exhibit alone—the colloid mill (the principal features of which were first described in THE CHEMICAL AGE by Dr. Schotz)—is certain to attract many visitors. The increasing attention given of late to the design and construction of chemical plant is already bearing fruit, and the concurrently increasing study of chemical engineering is similarly making for progress. All this will be well illustrated in the exhibits of various British firms. From time to time note will be made of the arrangements in the other chemical or allied sections. For the present it is sufficient to say that the organisation of the chemical exhibition is proceeding very satisfactorily and already gives every promise of success.

Points from our News Pages

Recent advances in metallurgical chemistry are dealt with in an article by Miss Elaine Eustice (p. 26).

A selection is given of readers' and advertisers' appreciations of the *Chemical Age Year Book* (p. 28).

A prize essay on the history of the United Alkali Co., Ltd., written by three members of the Company's chemical staff, is reproduced (p. 29).

Preliminary notes are given relating to the chemical plant exhibits at the forthcoming British Industries Fair (p. 31).

Summaries are published of four interesting papers read before the Manchester Section of the Society of Chemical Industry (p. 33).

The application of micro-organisms in industry and research formed the subject of a joint discussion of the Society of Chemical Industry and the Biochemical Society in London (p. 35).

According to our London Market Report, home markets continue healthy, while export demand is well maintained (p. 44).

Our Scottish Market Report describes the week's business as fairly satisfactory with numerous inquiries, many of which have resulted in business (p. 47).

Books Received

INDUSTRIAL ORGANISATION. By John Lee. London: Sir Isaac Pitman and Sons, Ltd. Pp. 120. 5s.

The Calendar

JAN.		
16	Institute of Metals (North East Coast Section): "Plastic Flow in Metals." By Professor C. H. Desch. 7.30 p.m.	Armstrong College, Newcastle-on-Tyne.
16	Hull Chemical and Engineering Society: "The Manufacture of Wood Extracts." By J. A. Reavell. 7.30 p.m.	Grey Street, Park Street, Hull.
17	Society of Glass Technology. 3 p.m.	The University, Sheffield
17	Society of Public Analysts: Joint Meeting with Nottingham Section of the Society of Chemical Industry. Discussion on "The Detection and Determination of Small Quantities of Arsenic." 7.15 p.m.	University College, Nottingham.
18	Chemical Society: Ordinary Scientific Meeting. 8 p.m.	Burlington House, W.1.
19	Finsbury Old Students' Association: Smoking Concert. 8 p.m.	Engineers' Club, London.
19	Society of Dyers and Colourists (Manchester Section): "The Behaviour of Titanium Hydroxide Towards Dyestuffs." Dr. J. K. Wood and A. M. Morley.	36, George Street, Manchester
19	Royal Institution of Great Britain: "Soap Films as Detectors; Stream Lines; Vortex Motion and Sound." Sir James Dewar. 9 p.m.	Albemarle Street, W.1.
20	The Mining Institute of Scotland: Annual Dinner. 5 p.m.	North British Station Hotel, Princes Street, Edinburgh.

Recent Advances in Metallurgical Chemistry

By Elaine Eustice, B.Sc., A.I.C.

Miss Eustice, who during the war was engaged in research work connected with the properties of metals, discusses the question of allotropy, and refers to the light which has been shed on a number of metallurgical problems by the recent method of Röntgen ray analysis.

In the chemical world all eyes have been turned upon the epoch-making work on atomic structure which is being carried out by bands of physicists and chemists all over the country, and it is interesting to contemplate that in metallurgy, too, the most recent and important advances have been made along the same lines by the aid of physical methods, and often by the hands of physicists, who are day by day revealing more of the mysteries of the atom and the internal forces at work within the very crystals themselves. The momentous discovery made some years ago by Osmond, of the existence of two thermal critical points in pure iron, respectively at about 768° C. (A2) and 900° C. (A3), was first accepted as proof that iron existed in 3 allotropic modifications—γ iron, stable above the upper critical point; β iron, stable between the two points; and α iron, stable below the lower point. This discovery was followed by an investigation of the difficult problem of the crystallisation of the different allotropes, when it was shown that they all three crystallised in the cubic system, octahedra being the prevailing crystalline form of Gamma iron, and the cube the prevailing form of Beta and Alpha iron. Further, the transformation of Gamma iron into the Beta iron appeared to include a change in the plane of symmetry—at least, in carburised iron.

In recent years great progress has been made in the investigation of crystal structure, and an intimate knowledge of the groupings of the atoms within the crystal, known as the space lattice of the crystal, has been added to the former knowledge of external crystallographic form. Parallel with this growth of knowledge there has arisen in the iron and steel world a great controversy as to the nature of the so-called Beta iron. It is universally accepted that Alpha and Gamma irons are separate allotropic modifications, but it is maintained by most of the eminent metallurgists in Europe that Beta iron does not exist as an independent phase but is identical with Alpha iron, whereas there is another school of metallurgists, principally American, which strongly supports the existence of Beta iron as a distinct and definite allotrope. Some years ago certain British metallurgists buried Beta iron with all due solemnity at a meeting held in this country, only to see it revived again in connection with the recent work on allotropy carried out by means of X-ray analysis, and to be described below. The crux of the whole position seems to lie in the lack of a sufficiently restricted definition of allotropy, and it is, indeed, unfortunate that metallurgists and, in fact, chemists in general, cannot agree upon this point.

Allotropic Transformation

Opinions differ as to whether a well-defined change in a single property constitutes a proof of allotropy; some insist on a crystallographic change, synonymous with polymorphy; others a spontaneous evolution of heat on cooling and absorption on heating at nearly the same temperature—*i.e.*, a spontaneous change of energy; others a dilatation on cooling and contraction on heating, while Benedicks defines the allotropic transformation point as the temperature at which two phases of the same substance are in equilibrium with one another. Some writers, further, exclude magnetic changes from those of allotropy. Intimately connected with the problem of Beta iron is the question which is absorbing the attention of many metallurgists to-day, namely, the explanation of the hardness of steel. It is a well known fact that, provided it contains sufficient carbon, a comparatively soft material can, merely by heating to a certain well-known temperature and quenching or cooling it quickly, become converted into a substance possessing glass scratching hardness. The facts are known, but an explanation of the mechanism is still being sought, and it seems as though the elucidation of the problem lies in the hands of the physicist equally with the metallurgist.

The work carried out during the past and current year by Dr. Arne Westgren and his colleagues at the University of Lund, Gothenburg, Sweden, which has thrown so much light on these two problems, is the result of the rapid development of Röntgen spectographic investigation methods, which originated in 1914 by M. Von. Laue's discovery that Röntgen rays passing through a crystalline system caused interference phenomena. W. H. and W. L. Bragg made a further advance by studying the reflection of Röntgen rays against crystal surfaces, from which they developed a practicable method of determining crystal structure. According to these investigators, the crystal is oriented in a certain way in relation to the direction of radiation at each experiment. By working with a single crystal of sufficient perfection, and observing and photographing by means of X-rays the reflection from two or three known planes, photograms were obtained of a certain definite structure, and it was then possible to calculate the atomic arrangement which gave the spacings and interstices for these planes. Where single crystals of sufficient perfection are available, the Bragg method of investigating space lattice is by far the simplest, but such perfection is not always possible, and very often the crystal structure of a substance which can only be obtained in the form of small and very irregular crystals is required. The elucidation of this problem is due to the work of Debye and Scherrer, and, independently, Hull.

It was found by Hull that when perfection was not available the next simplest condition was perfect chaos, and this was effected by the random grouping of a great many minute crystals of the same material, such that there was equivalent partition of reflecting opportunity among all the crystal planes. If enough crystal positions are present, all interferences possible must occur. A single photograph was taken which contained reflection from a large number of unknown planes, and a structure was sought whose *whole pattern* of planes, arranged in the order of decreasing spacing and omitting none, fitted the observed pattern. In any case it is a method of trial and error, viz., to try one arrangement with another until one is found that fits, and considerable mathematical calculation is involved, but the results amply justify the procedure, and where a check is made by applying it to crystals whose structure has already been obtained by the Bragg method very satisfactory agreement has been recorded.

The quantity of material required was small, and extreme purity was not necessary. The substance was reduced to as finely divided form as possible by filing, crushing, or by chemical or electro-chemical precipitation or distillation. It was placed in a thin walled glass tube, and kept in continuous rotation while a narrow beam of monochromatic X-rays was passed through it. The diffraction pattern obtained, which should contain reflections from every possible plane in the crystal, was photographed. There are two obvious disadvantages, namely, that as the opportunity of any one phase to reflect is very small, a long exposure is necessary, and further, the images from all the planes appear on the same plate, so that it is impossible to tell without calculation which image belongs to each plane.

Crystal Structure

Hull applied this method for determining the crystal lattice of ten elementary crystalline substances, notably that of iron, from two sources :—

(*a*) Fine filings of pure electrolytic iron.

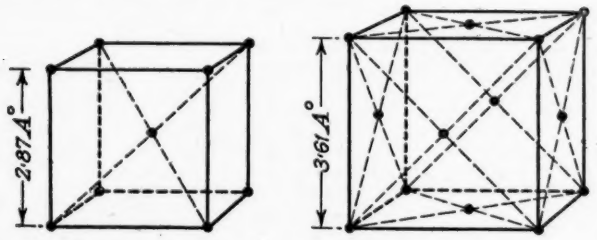
(*b*) Fine iron powder obtained by the reduction of ferric oxide in hydrogen.

The crystal structure obtained was that of a cube-centred cubic lattice; the edge of the cube was 2·86 Å units (1 Angstrom $=10^{-8}$ centimetres).

The presence in iron of 3½ per cent. silicon did not greatly affect it, the lattice structure was the same, and this was verified by some measurements by Bragg's method. In Debye and Scherrer's experiments, which were conducted along very

much the same lines, the sample, compressed into the shape of a cylindrical rod, was placed along the axis of a cylindrical camera made from lead, the inner walls of which were covered with a photographic film. The Röntgen light fell into the camera through a narrow tube and was directed towards the centre of the cylindrical specimen. After an exposure lasting a few hours, the film, when developed, showed lines which were obviously lines of intersection between the film cylinder and conical surfaces of radiation. This preliminary work was all carried out at ordinary temperatures and only upon soft iron. Westgren and other workers at Lund now proceeded to elaborate the method and to apply it to iron and steel of varying compositions and treatments and at different temperatures. In the first place the results obtained by Hull were verified, and following upon this the work was greatly extended.

The Röntgen tube used was of the Siegbahn type, made of Skefko ball bearing steel, free from slag inclusions and heterogeneities. It was run with a current of 15 to 20 milliamps, at a voltage of 40,000 volts. The anticathode was cut off perpendicularly to the axis and an iron plate was soldered on. Around the anticathode were arranged three aluminium windows, through which the Röntgen radiation emerged, allowing exposures to be taken simultaneously in three cameras. The cameras in general were of the same type as those used by Debye and Scherrer, and consisted of cylindrical, thick walled lead vessels which could be closed by a lead lid. A special camera was designed for exposures at high temperatures consisting of an ordinary camera fitted with special devices for cooling the camera, heating the specimen, and the introduction of an inert gas to prevent oxidation. The specimen, instead of being in the form of filings, was a cylindrically ground rod of the dimensions 10 by 2 millimetres. It was heated electrically, and the temperature determined approximately by an optical pyrometer.



α-(β-, δ-) Iron.
Cube centred cubic lattice.

γ- Iron.
Face centred cubic lattice.

As has been indicated above, the first procedure was to verify Hull's work, and, as a result, it is now firmly established that pure iron at ordinary temperatures has a cube-centred cubic lattice—*i.e.*, a lattice built on a cubic pattern in which each element might be supposed to consist of one atom at each corner and one at the centre of the cube. This is iron in its Alpha state. Iron in its Gamma state—*i.e.*, in austenite steel, was next investigated by quenching from high temperatures and undercooling so as to render it practically stable at ordinary temperatures. Spectograms were taken of two such steels, a nickel steel (Ni=25·2%) and a manganese steel (Mn=12·1%), both quenched in water from about 1000° C. It was found that the austenite crystals had face-centred cubic lattices—*i.e.*, the atoms were close together like a pile of shot, the unit of pattern was still the cube, but there was an atom at each corner of the unit and one at the centre of each face.

From this investigation of ordinary iron at room temperature and of austenitic steels, it can be concluded that Alpha iron and undercooled Gamma iron have different crystal structures. To determine the Beta iron and Gamma iron lattices in a stable state, exposures were made at 800°–830° C. and at about 1000° C. in the specially contrived camera described above. The specimen used was a fine iron wire (99·9% iron) with a Beta iron interval of 768°–880° C. For Beta iron a spectogram with very clear continuous lines was obtained. At 1000° C. the films only showed black spots, but it was sufficient to show that Beta iron has the same lattice as Alpha iron, and at 1000° C.—*i.e.*, in the Gamma iron interval, iron crystals have the same structure as in the austenitic steels. The edge of unit cube for iron at 800°–830° C. is 2·92 A (theoretical value 2·90 Å), and at 1000° C, 3·60 Å (theoretical value = 3·65 Å).

It was found in general that a fine grained metal gave a good distribution of smooth lines on the films, while a coarse grained structure was spotted and showed dashed lines. In some cases patterns were indistinguishable from each other, as in the case of the austenitic manganese steels and nickel steels described above, but generally the pattern was absolutely characteristic of the substance. These spectograms prove that while no definite transformation takes place in the crystal structure of iron at the first critical point (A_2), there is a very striking difference at the second point (A_3), resulting in the entire rearrangement of the atoms and the passing of iron from one class to another. It is thus obvious that the difference between iron in the Alpha and Beta states is not of the same kind as between the Alpha and Gamma states.

The question of the structure of martensite and the condition of the hardened carbon steels was next investigated. When the manganese steels and nickel steels referred to previously were quenched from 1000° C. in ice cold water the manganese steel still gave the Gamma iron spectograms, but the nickel steel was materially changed, and was probably a mixture of Alpha and Gamma iron. The photo-micrographs of the two specimens showed the manganese steel still to consist of austenite while the nickel steel showed coarse martensitic needles mixed with austenite. Hardened carbon steels and high-speed steels hardened at 1275° C., which were examined for their martensitic structure, all gave Alpha iron lines, thus showing that in martensite the iron atoms are oriented in exactly the same way as ferrite; in fact, the iron is identical and the only difference is due to the carbon present.

Influence of Carbon Atoms

The nature of the influence of the carbon atoms on the iron lattice and the crystal structure of cementite were the next two problems which the Swedish workers set themselves to solve, and the results of their investigations have appeared in a very recent paper. The camera described was reconstructed so as to enable experiments to be carried out at higher temperatures. A glowing iron wire was rotated during the X-ray examination, and by this means a very distinct line photogram of Gamma iron (1100° C.) was obtained, and, further, the structure of iron at 1425° C. was determined. The time of exposure was two and a half hours, and although the lines obtained at low temperatures were clear, it was found that as the temperature became very high there was a certain amount of blurring, probably owing to the pliability of iron wire at such temperatures. At 1425° C. it was difficult to keep the temperature steady, especially as in order to prevent grain growth, it was necessary every few minutes to vary it and to bring it down within the range of another modification, which meant that traces of other modifications were always present in the photogram.

Sufficient evidence was obtained, however, to show that the lattice transformation which takes place at 900° C., *i.e.*, Alpha-Gamma, is reversed at 1425° C. when a new phase of iron is entered upon called Delta iron, which has the same crystal structure, *i.e.*, cube centred cubic lattice, as Alpha iron. The existence of Delta iron is now established, as well as the fact that of the four modifications of iron three possess the same form. The effect of dissolved carbon in the Gamma lattice structure of austenite was investigated, and it was found that it produced a uniform enlargement of the lattice. The lines of the photograms of austenite containing high carbon are very distinct and clear, and a steel with 1·98 per cent. carbon has a somewhat larger lattice when quenched from 1100° C. than from 1000° C.

The spectogram of martensite, on the other hand, has very faint and diffuse lines though a similar enlargement of the lattice by carbon atoms is visible. The ranges of a homogeneous Alpha iron lattice in martensite have proved to be extremely small, and steel with 0·80 per cent. carbon quenched in water from 780° C. is on the verge of being almost completely amorphous.

Finally, the latest achievement at Lund is the determination of the crystal structure of cementite, which is found to be

identical with crystal plates of Spiegel iron. It belongs to the ortho rhombic system, the ratio of its axes are 0·670 : 0·755 : 1, and the dimensions of its elementary parallelepiped are 4·53 : 5·11 : 6·77 Å units.

Perhaps it would be of interest at this point to consider the position of the Beta iron theory and the old theories of the hardening process of iron and steel in the light of this newly acquired knowledge of the internal crystal structure of these metals. To those who regard allotropy as synomynous with polymorphy, Beta iron as a separate allotropic modification is of a surety as dead as those metallurgists who solemnly buried it in the past would have it to be, for it has been proved by Westgren beyond all doubt that no change of crystal structures takes place at the first critical point (A_2). To those, however, to whom allotropy has other meanings there is still the spontaneous change of energy which undoubtedly occurs on heating or cooling in the neighbourhood of 768° C., and further there is a distinct change in magnetic properties which remain unaccounted for if Beta iron is not an allotrope. It is true that X-ray analysis shows only lattice structure, and any change such as magnetic properties, which may be due to change of surface forces on the atom and not the change of relative position of the atoms, would pass unobserved. Evidence seems to point, however, to a conclusion that the Alpha-Beta process is not a sudden change, but is a gradual and progressive one, beginning at the lowest temperature and ending at 768° C., and that the differences between iron below 768° C. and iron between 768° C. and 900° C. is not that which usually exists between two allotropic modifications, whereas the difference between iron below 768° C. and iron between 900° C. and 1425° C.—*i.e.*, between Alpha iron and Gamma iron—is that of true allotropy.

Hard and Soft Steel

The old allotropic theory of the hardening of steel attributed the peculiar properties to a solution of carbon or carbides in Beta iron. Since Beta iron has been shown to be not fundamentally different from Alpha iron a new carbonist theory has been expounded attributing the hardness to the presence of different carbides in steel, many of which have been isolated by Arnold and other workers. Westgren's recent work has very conclusively shown that the fundamental crystal difference between soft and hard steel lies in the distortion of the lattice of the latter by carbon atoms, which throws considerable light on the problem, and it is hoped that further work will completely elucidate this difficult question to the entire satisfaction of all metallurgists.

It is difficult at this early stage to estimate the importance of the application of X-ray methods of investigation to problems relating to metals and alloys since the field has only just begun to be explored, but already the possibility looms ahead that the real future of all our knowledge of the internal structure of metals may be in this direction.

From a study of the lattice of metals and metal alloys and the laws of force that govern lattice equilibrium, it ought to be possible theoretically to determine the strength of systems, and in this way problems dealing with strength of materials, which have hitherto been soluble only by empiric methods, will be based on a rational scientific foundation.

Safeguarding and Dyestuffs Acts

Manchester Traders Demand Repeal

On Monday the board of the Manchester Chamber of Commerce had before them the results of the recent referendum with regard to the Safeguarding of Industries and Dyestuffs Acts, which showed a majority in favour of the repeal of the Acts. After some discussion, the following resolution was adopted, by 22 votes to three, for submission, together with the referendum figures, to the Government :—

"The Board of the Chamber of Commerce, realising that the Safeguarding of Industries Act and the Dyestuffs Act are proving both injurious and irritating in their effects, and in view of the declaration of the members of this Chamber on a referendum vote in favour of their appeal, calls upon His Majesty's Government to repeal these Acts at the earliest possible moment. They further suggest that in so far as safeguarding of certain industries may be essential for national safety, such end can be secured by means of a subsidy."

"The Chemical Age Year Book"

What Readers and Advertisers Think

We publish below a selection of extracts from letters relating to *The Chemical Age Year Book*, the first volume of which has just been published, together with references to The Chemical Age itself, from readers and advertisers. With regard to the *Year Book* (the price of which to non-subscribers is 10s. 6d.) it should be explained that every annual subscriber to The Chemical Age is entitled to a free copy. Where subscribers, however, obtain their copies through a newsagent or by other indirect means the publishers may have no record of their names and addresses. If any such subscribers who have not received copies will kindly communicate with the Manager, The Chemical Age, 8, Bouverie Street, E.C.2, forms will be supplied entitling them to a free copy of the *Year Book*. The following brief extracts indicate what readers think of the first volume :—

"We thank you very much for the *Diary*, and must compliment you upon its production and the collection of useful chemical information. It is exceedingly well printed, and the advertisements are a very representative collection of the firms in the British chemical trade. Wishing you the compliments of the season and continued success in chemical technology."

"I beg to acknowledge with many thanks the receipt of *The Chemical Age Year Book* for 1923. It is a very useful volume, and the information and tables contained in it are of great value."

"Mr. —— desires me to thank you for *The Chemical Age Year Book* for 1923, and would like to congratulate you on this very interesting and useful production."

"Thanks very much for *The Chemical Age Year Book* for 1923, just received. The book will prove most useful."

"The *Year Book and Diary* to hand to-day, for which I cannot thank you sufficiently. I have examined its contents and see that it will prove a useful instrument to the chemist and chemical engineer. Please accept my best thanks and wishes to The Chemical Age."

* * *

From an Analytical Chemist.—"I have obtained your journal for the past two years through my newsagent. May I say that it is a most valuable paper and one that no chemist should be without.—December, 1922."

From a Colonial Government Department.—"I desire to thank you for your courtesy in supplying the missing copy of The Chemical Age. Will you please let me know if it is possible for you to supply us with Volumes II and III? We are most desirous of keeping our files intact, and your journal is of especial value to our library. If it is available, we should like to purchase through the required Government channel at as early a date as we can.—July, 1922."

From a Well-known Chemical Firm.—"We have been subscribers to your journal for three or four months, and we know you will be glad to hear that we consider it an extremely good journal, and we find it most useful. The writer reads it regularly and carefully every week, and we have already obtained information of service to us. It seems to us to fill a want between a purely scientific journal and a trade paper.—September, 1922."

From an Engineering Firm.—"We have found your journal of great value to us in getting into touch with people in the chemical industry who are interested in our manufactures. It may be of interest to you to know that the first advertisement we inserted had not been out more than one or two days before we received several direct inquiries, and that as a result a number of these matured into firm orders.—February, 1922."

From a Dyestuffs Research Chemist.—"I am glad of the opportunity of congratulating you on the value and interest of The Chemical Age.—October, 1922."

From a Consulting Chemist.—"I would like to take this opportunity of expressing great satisfaction in The Chemical Age and to say what an excellent and helpful publication it is.—November, 1922."

From a Professor of Chemistry.—"I would like to say how much your journal is appreciated here, the 'Week to Week' and 'Current Literature' columns being especially useful.—September, 1922."

The Centenary of the United Alkali Co.

A Hundred Years of Chemical Progress

In connection with the centenary of the United Alkali Co., which will be celebrated during the month of April, an invitation was recently given to the staff to submit essays on the history of the concern. The enclosed contribution, prepared by three members of the chemical staff at Widnes, was one of those selected for a prize; it will be seen that it covers comprehensively the main outlines of the history of the alkali industry in this country and of the great chemical achievements associated with the Muspratt family.

To the traveller in the world of science, with his eyes always fixed on the ever-changing horizon, there will again and again come the opportunity for brief retrospective glances over the ground already covered. Such an occasion presents itself with the advent of the year 1923, when the centenary of the alkali industry in this country is to be celebrated. The history of the evolution during the past hundred years of that colossal structure, the modern chemical industry, is one long sequence of struggles of giant intellects striving to wrest further secrets from Nature for the service of their fellow-men. Until J. Muspratt, in 1823, laid the foundation stone of the chemical industry in this country, very few attempts had been made to manufacture chemicals on a large scale. Small works erected by Tennant on the Clyde and by Losh on the Tyne were already producing bleaching-powder and solutions of chlorine. These products had given great impetus to the work of the hand-loom weavers, by effecting in a few hours the bleaching of their wares, which previously had required months of exposure to sunlight. The industrial production of soap, however, requiring a supply of alkali, was entirely dependent on the ashes of wood and seaweed for its existence. Attempts had been made on the Continent to produce alkaline carbonates, and of these by far the most successful was due to the unfortunate French scientist Nicholas Leblanc.

Introduction of the Leblanc Process

The abolition in this country, in 1823, of the extravagant and crippling tax of £30 per ton on common salt, the raw material of the Leblanc process, gave to the enterprising James Muspratt the idea of introducing the process into England. This opportunity he was not slow to seize, and with very little capital he commenced to manufacture sulphuric acid and carbonate of soda on the banks of the Mersey. His choice of a site was ideal, for he had excellent shipping facilities, and was within easy reach of the salt deposits of Cheshire and the coal-fields of Lancashire.

The life of a pioneer is invariably beset with difficulties, and James Muspratt's career proved to be no exception. At that time it was not considered within the range of probability that the dense fumes of hydrochloric acid produced by the action of sulphuric acid on common salt could be utilised; they were accordingly conducted away through tall chimneys in the hope that they would diffuse into the atmosphere and become sufficiently diluted to be innocuous. Fortune, however, behaved in her customary fickle way, and by means of rain and wind returned the fumes to earth, causing material damage to crops and vegetation.

As a result of this, Muspratt's time was almost entirely occupied in unprofitable litigation with neighbouring land-owners and farmers, and his opportunities for further research in the scientific improvement of his works were reduced to a minimum. His enterprise, for a short time, took him to St. Helens in partnership with Gamble, and later he established a works at Newton. He continued to be embroiled in legal disputes till finally he settled down in Widnes, when his difficulties abated owing to more convenient surroundings. With his coming, in the year 1850, Widnes entered upon a period of great commercial activity, the population increasing from 4,000 to 25,000 in the short space of twenty years.

The vexed question of the removal of the corrosive fumes of hydrochloric acid was successfully solved by William Gossage. His simple device of absorbing the acid in water, by means of towers packed with coke, not only removed one of the greatest obstacles to the progress of the industry but also provided an invaluable by-product. The recovery of this acid in solution paved the way to further discoveries, which stand out as landmarks in the development of the Leblanc industry, and to which the industry was to owe its very life.

The process of soap-making now made rapid strides with the introduction of caustic soda as an article of commerce. For this product, which was first manufactured by William Gossage in Widnes, there was soon a heavy demand, with a consequent increase in the prosperity of the alkali trade. Many new works sprang up in this district, one of the most important being that of Henry Deacon, which later developed into the well-known firm of Gaskell, Deacon and Co.

The abundant source of hydrochloric acid provided by the Gossage condensing towers gave rise to further scientific inquiry as to the best means of obtaining from the acid the chlorine it contained. The year 1869 witnessed the introduction, by Weldon, of his now famous method of recovering the expensive manganese, which had hitherto been wasted.

The following year saw the discovery by Deacon and his able assistant Hurter of the atmospheric oxidation of hydrochloric acid, using cupric chloride as catalyst. Both of these important developments were first put into practice in works which were later to link up as important units in the United Alkali Company.

The Genius of Ernest Solvay

The prosperity enjoyed at this time by the Leblanc soda manufacturers was soon to be seriously threatened by the genius of Ernest Solvay. Applying himself to the mechanical aspect of the alternative method for producing alkali, by the interaction of ammonium bicarbonate and brine, he gained the objective for which the pioneers of the alkali industry had striven yet failed to reach. The reaction, first observed by Thom in 1836, had been studied by James Muspratt, William Gossage, and Henry Deacon, but without success. In 1872 Solvay's victory over the engineering difficulties of the reaction led to the erection of a plant at Northwich, based on his design. This clean and simple process, producing bicarbonate of soda in a single operation without the waste products so characteristic of the Leblanc method, placed alkali on the market at a much reduced figure. From being a formidable competitor of the established industry, it soon developed into a danger to the continued existence of the older method of manufacture.

It was recognised, however, that the Leblanc process carried with it several inherent advantages not possessed by its rival. It necessitated, for example, the production of sulphuric acid, a commodity which was finding increased uses daily. Its main by-product (hydrochloric acid) far from being a stumbling-block to progress, as in earlier times, was now a valuable source of chlorine, facilitating the production of bleaching powder, chlorates, and hypochlorites, and was itself finding new applications in many industries. The perfection by Chance in the year 1888 of a method of reclaiming the sulphur formerly lost in the calcium sulphide of the so-called "vat-waste," opened up a new source of wealth, and completed a cycle of operations in which every valuable material was recovered. The Chance sulphur process was the means of placing sulphur on the market in a very pure form, and converting what had been a public nuisance into a source of profit.

Such, therefore was the position in 1890, when practically all the Leblanc soda manufacturers of the country, for their mutual protection and progress, combined to form the United Alkali Company.

Development of By-products

A vigorous policy was at once pursued in the utilisation of all by-products, thereby placing on the market a wide range of chemicals known everywhere for their standard of purity and excellence. Thus, producing sulphuric acid in all strengths, the company has not only been able to satisfy all demands for this product, but by means of this acid has been enabled to place on the market such commodities as nitric acid for dye-making and explosives, acetic and formic acids for textile uses, and superphosphates for agricultural purposes.

The numerous chlorine products of the company find application in textile industries, laundries, explosive and

match factories, and in sanitary and civil engineering. This wide range of products manufactured by the United Alkali Company has placed it in a position indispensable to the industries of the country.

Recognising, further, that the Leblanc soda process was only kept alive by the value of its by-products, the company in 1892, after the expiration of the Solvay patents, established a works at Fleetwood for the production of sodium carbonate by the ammonia-soda process, and thus became equipped to withstand all competition.

To consolidate its position, the company determined to render itself independent of all fluctuations in the prices of the raw materials necessary for its chief processes, and to this end acquired extensive sulphur mines in Spain, salt deposits in Lancashire and Cheshire, and lime quarries in Derbyshire. More recently a plant has also been installed for the atmospheric oxidation of ammonia to nitric acid, thus rendering the firm independent of the Chile nitre-beds.

The rapid advances of electrical science had for some considerable time been attracting the attention of chemists. As early as 1851 an attempt had been made to manufacture caustic soda electrolytically from brine, but owing to the difficulty of separating the products the process was a failure. The increasing interest in electrolytic methods had attracted the attention of Deacon and Hurter, and from 1887 onwards the latter made many investigations on the value of this method in relation to the alkali industry. It remained, however, for Castner to solve the problem in 1892 by the introduction of his mercury-cell. This was not at first an unqualified success, but the perfecting of the Gibbs Diaphragm Cell in America gave the United Alkali Company its opportunity. Acquiring the patent rights for this country, it successfully established large plants in various districts for the electrolytic manufacture of caustic soda and chlorine of high purity, thus finally sounding the death-knell of the Leblanc process and its attendant recovery plants. New outlets for chlorine were found to be necessary, and the company accordingly erected a works to produce organic intermediates for the dye industry.

War Work

As will be gathered, the United Alkali Company was in a very strong position at the commencement of the Great War, the value of its organic plant being immediately felt in the ease with which it was converted into an explosives factory. More important still was the value of its huge vitriol plant. With the sudden and unprecedented demand for explosives, necessitating a large supply of concentrated vitriol, the company immediately placed its extensive works at the disposal of the Government, and kept the country supplied until the requisite national factories had been built.

To meet the critical situation arising from the shortage of oleum, large units were erected for the production of this acid by the contact processes already inaugurated by the Mannheim Company and by Schröder and Grillo. These units were eminently successful, and contributed to the output of high explosives in this country. The entire staff, solidly welded into one corporate body in the face of national danger, spared no effort to produce the equipment necessary for our fighting men.

Illustrative of the part played by the United Alkali Company during the war, the following figures of chemicals supplied to the Government are of interest :—

	Tons.
Vitriol	1,000,000
Oleum	30,000
Bleaching powder	150,000
Caustic soda	120,000
Ammonium nitrate	46,000
Dinitrophenol	10,000
Ammonium perchlorate	4,000
Chlorine	2,300
Phosgene	2,000

When the world, slowly recovering from the upheaval of the war, regains its normal intercourse, there can be little doubt that a new era of prosperity will dawn for the whole commercial life of this country.

For the United Alkali Company, intimately interwoven as it is with the industrial activity of the nation, the future is bright—a future worthy of those who have laboured, during the past hundred years, to erect this lasting monument to their enterprise, courage and endeavour.

Catalogues Received

SOFNOL, LTD.—An interesting 27-page booklet on "Water Testing," which has been issued by Sofnol, Ltd., Westcombe Hill, Greenwich, London, S.E.10, gives complete instructions for the testing of untreated waters, softened waters and boiler waters. In addition to an exposition of the advantages of the company's automatic graduated self-adjusting burettes, standard hard water, standard acids, silver nitrate solution, indicators for hard and soft waters, etc., the booklet refers to a special soap for testing the hardness of waters, which, it is claimed, does not become cloudy or deposit any sediment when exposed to cold; it is further said to give a brilliant characteristic lather which does not readily break up in the same way as the lathers obtained from ordinary soap solutions. In this connection it is pointed out that some imperfectly made soap solutions do not give distinctive lathers towards the end point of the reaction, and when more than the requisite quantity of soap is added the lather breaks up and cannot be renewed, even by the addition of a large excess of soap solution. This special soap solution can be made in any desired strength, but the makers recommend a strength which corresponds to N/50 acid—*i.e.*, each c.c. of soap solution is equivalent to ·001 gramme of carbonate of lime. Instructions are given for testing hard and treated water, the estimation of sodium chloride and the estimation of free oxygen. We understand that a copy of the booklet will be supplied to readers of THE CHEMICAL AGE on application to the company.

MELDRUMS, LTD.—This firm, whose offices and works are at Timperley, Manchester, have just issued a description of the Meldrum oil burner for Lancashire, Yorkshire, Cornish, vertical and water-tube boilers, heating and annealing furnaces, bolt and rivet furnaces, etc. In the "Meldrum" burner atomisation is effected by steam or compressed air. The oil passes through the inner of two concentric tubes, while steam passes through the annular space between the tubes, thus preheating the oil. The heated oil then flows over a narrow slit from which the steam is issuing, with the result that the oil is broken up into fine particles ready for burning. Oil and steam valves with pipe connections, a steam pressure gauge which registers the jet pressure, and a dial regulator are provided, thus enabling a minute regulation to be made and allowing of instantaneous adjustment to a pre-determined condition after stoppage.

RELAY AUTOMATIC TELEPHONE CO., LTD.—Modern business men realise the importance of taking every possible advantage of time and labour-saving appliances. One of the first essentials of any business organisation is an adequate and reliable telephone service. In this connection a booklet issued by the above company from Marconi House, Strand, London, W.C.2, sets forth the advantages of the "Relay" automatic telephone system. Not the least important of these are immediate connection, clear and secret transmission of speech, the elimination of human operators and wrong numbers, instant disconnection from any one number and immediate re-connection to any other that may be required.

MR. G. A. COWIE.—From 29, Victoria Street, Westminster, London, S.W.1, Mr. Cowie issues a leaflet entitled, "Fertilisers for Grass Land," which, he states, will be supplied gratis to readers of THE CHEMICAL AGE. It is pointed out that the improvement of grassland is essentially dependent on the application of phosphates, or of both phosphates and potash. Illustrations are given showing the definite advantage of treatment with both forms of fertiliser.

MICHELL BEARINGS, LTD.—This company, whose offices are at 2, Central Buildings, Westminster, London, S.W.1, have brought out a second edition of their brochure on the "Michell" "cup and ball" viscometer. The Michell instrument consists of a cup of steel or cast iron having a perfect concave surface, and is provided with a hollow stem or handle which forms a thermometer pocket extending into the metal of the cup. The surface of the cup has three minute projections which prevent the steel ball from making complete contact, and regulate the thickness of the film of fluid under test. In order to protect the concave surface and to accommodate a surplus of the fluid, the cup is slightly recessed all round its edge. Viscosity is measured by taking the time required for the ball to fall from the inverted cup. Instruction is given in the use of the viscometer, and comparative curves of tests made with the Michell and the Redwood viscometers are shown.

Chemical Plant at the British Industries Fair

Preliminary Notes on a New Section

THE chemical section of the British Industries Fair of 1923, to be held on the four days beginning on Monday, February 19, will, as already announced, be considerably more comprehensive than that organised last year, successful as it undoubtedly was. Prominent among the new sections will be one consisting of chemical plant, which there is every reason to believe will be found to be thoroughly representative of the chemical plant industry in the United Kingdom.

The exhibit will, where possible, be the actual articles of commerce, supplemented by models, photographs and line drawings of apparatus and plant of every description pertaining to the chemical and allied industries in course of construction and completely erected. Such exhibits will include, for instance, acid resisting plant, acid elevators and pumps, autoclaves, carbonisation plant, dye pans, digesters, distillation plant, dryers, evaporating plant, jacketed pans, mixing plant, pipes and accessories, retorts, stills, tanks, etc.

Acid Resisting Enamelled Cast Iron Plant

Possibly there is no chemical plant so widely useful as that made of cast iron lined with acid-resisting enamel. The enamel must be lead free, as the presence of this or any other injurious ingredient is fatal to the successful manufacture of fine chemicals. Vessels in this ware are obtainable from a few inches up to 7 feet in diameter. Evaporating bowls and dishes are extensively used in laboratories, especially those of smaller diameters, the larger sizes being of value where rapid output is desired. Jacketed pans, in which the temperature can be raised either by means of steam or by adapting a jacket for use as an oil or sand bath, suit many purposes. Round pans with curved or flat rims may be fixed separately or in ranges for heating by flues arranged to circulate the heat generated evenly over the surface of the vessels.

Nitrating pans and sulphonating pots in sizes from 1 pint to 500 gallons are adaptable for use with agitators of varying descriptions as desired. Stills, either steam heated or worked under vacuum, will be shown. These meet many demands, and branches on covers can be supplied to specification, and fractionating columns are made to fit between cover and still front. The cast-iron buckets to be shown will prove useful, as the enamel resists the action of most acids.

The sulphonating pots to be shown, for laboratories and for the output of certain fine chemicals (required only in moderate quantities) are made from ½ pint up to 10 gallons capacity. They are readily jointed, and the covers can have two or more branches as desired, including the centre ones, which can be adapted for use of an agitator. The cast-iron pipes and elbows to be shown are made in varying diameters, and are invaluable where acids are required to be conveyed from one vessel to another.

Coal Carbonisation

The exhibits of one firm will cover apparatus and plant for the treatment of the products, in the gaseous and liquid form, of the carbonisation of coal. In addition to the manufacture and installation of complete plants for production of town gas, by-products and metallurgical coke, this exhibitor specialises in apparatus for washing to obtain the various by-products from gas, such as ammonia, benzol, cyanides, etc., and the working up and refining of these products on a commercial scale.

This exhibitor also specialises in the production of large-sized experimental installations in connection with various types of carbonising plants for the production of low temperature domestic fuel and also gas for power purposes, and the production of liquid fuel for internal combustion engines.

A collection of photographs will be shown of drying machinery, centrifugals, evaporators and filter presses, together with diagrams relating to performance and other interesting particulars.

Mulsers

An interesting exhibit will be that of a special machine for perfecting medicinal and other emulsions, so as to render them perfectly homogeneous or fixed, so that they will not afterwards separate. It improves the colour of the emulsion and disintegrates the oil globules and causes the emulsion to assimilate more easily.

Shortly stated, the action of the mulser is to pump the emulsion under a pressure of 100 to 120 lbs. per square inch through very fine orifices against a revolving disc compressed by a spring against the surface of the plate containing the orifices, which allows the liquid to exude through under any required pressure while it is being rubbed down, and prevents the orifices becoming clogged or blocked, and produces white creamy emulsions which pour freely and do not separate.

The Colloid Mill

An exhibit sure to attract much attention will be a high-speed colloid mill for the preparation of colloids and emulsions, together with specimens of the products treated. The colloid mill is the only machine for colloidising all solids and liquids. When reduced to the colloidal condition a substance acquires new properties of becoming miscible with certain liquids and solids in which it is generally insoluble. Such intimate mixing is the ultimate aim in many industries—*e.g.*, paint manufacture—and this miscibility is utilised for achieving a rapid and complete chemical change or reaction. The following applications may be specially noted :—

Road Construction.—By mixing bitumen and water in the colloid mill a liquid mass is obtained which can be employed like ordinary tar. *Dust Laying*.—A tar preparation for spraying the roads, which binds dust and dirt firmly to the road surface. *Lubricants*.—The mill can be used for making liquid or pasty emulsions of oil and water possessing high lubricating power and can also be utilised to produce "oil-soluble" graphite. *Disinfectants*.—All kinds of oils for disinfection can be mixed with water, resulting in pure and strong solutions. *Liquid Coal*.—Coal ground in oil gives what is claimed to be an ideal fuel. *Soap Making*.—Superior soap can be produced in the mill easily and cheaply. *Varnishes* can be prepared from hard gums without "running." *Paints* can be refined. *Copying, Typewriting, Printing and other Inks* yield beautifully smooth and permanent liquids or solids. *Milk* can be homogenised in the mill. *Medicinal Emulsions and Pastes*.—Cod liver oil emulsions of high purity and permanency are easily formed, also zinc and other pastes. *Purification of Minerals*.—Minerals can be freed from impurities, and precious ores and metals concentrated. *Superfine Grinding*.—Wet grinding can be carried out to a fineness equivalent to 125,000 meshes per linear inch, or even finer.

The following materials have been successfully treated in water, the product of which is used for many miscellaneous purposes :—Tallow, wax, fish oils, rubber, paraffin, etc. A special high-speed colloid mill will be shown.

Aluminium Plant

The plant to be exhibited by one firm is for the most part constructed of aluminium sheet. The joints are made by means of their patented welding process, which ensures the same mechanical strength as that of the unwelded portion of the sheet. The joint is finished perfectly smooth and is practically unrecognisable to the eye. Chemically it contains nothing but pure aluminium.

A steam pan to be exhibited is made on this principle, and introduces the new feature of having the inner and outer vessels made of the same material, aluminium, the two portions being welded together, thus eliminating the usual steam joint, which is necessary where a liner is fastened to a cast-iron jacket. The cost of this steam pan is no higher than that of the ordinary lined cast-iron steam-jacketed pan. This vessel can be made either to tilt, as is usual for most foodstuffs, or fixed, when an outlet is placed in the bottom to drain the vessel completely, as is more usual in chemical practice.

Tanks, buckets and small articles included in exhibit are also made by the welding process, and are so constructed as to eliminate rivets and folded joints, which have not proved successful with aluminium plant. The special features claimed for aluminium plant are :—

1. Where foodstuffs are concerned, this metal is practically alone in that all its salts are tasteless, colourless and non-poisonous. Its use gives, therefore, complete security against any possibility of poisoning, while the special design of all the vessels insures against the possibility of the lodgment of stale matter which might later find its way into foodstuffs.

2. Where chemical manufacture is concerned, aluminium is highly resistant to many chemical products which act upon other materials, causing by their solution the introduction of coloured or other undesirable substances into the product. Where corrosion does take place the colourless and harmless nature of aluminium salts prevents deterioration or depreciation of the product.

Filling Machines

Other exhibits in this section will comprise machines for filling glass bottles and jars and shallow tins, machines for filling automatically tin bottles and cans, drums and casks, and for automatically apportioning liquids; machines for taking samples of liquids and powders, etc.

There will be exhibited automatic can-filling machines, electrically controlled, which require very little current to operate them; machines which can be operated from the lighting circuit or by means of Leclanche cells, three cells being sufficient.

The wide range of filling is very remarkable, in one class of machine it is from one ounce to one ton. Another type of electrically controlled machine can be adjusted to fill accurately one drop or one pound at each movement, at any speed up to 60 per minute. Any intermediate weight can be filled, and ranges from one ounce to ten pounds can be obtained from the same type of machine.

The machines to be exhibited deal only with liquids and semi-liquids. They work with remarkable accuracy and speed. They are used for filling paint, varnish, enamel, edible oils, lubricating and illuminating oils, soft soap, insecticides, disinfectants, petrol, benzene, methylated spirit, tanning extracts, fluid extracts, hot fat, lead, etc., into thin flasks, tin bottles, cans, drums, boxes and casks.

These machines fill by weight. Adjustments are made very quickly, special facilities are provided in regard to quick changes from one kind to another, as, for instance, in paint filling, and rapid cleaning is easy.

The machines give a large output, one pound and two pound cans of paint are filled at the rate of 40 per minute and are so accurate that one will balance against another; six gallon drums are filled with edible oil in 18 seconds, 10 gallon in 22 seconds.

Another class of electrically operated machine fills predetermined quantities of fluid beef, essences, tinctures, etc., into bottles; these machines are used also as apportioners in manufacturing.

Machines are to be shown capable of filling liquids into glass bottles of every shape and size. The use of these machines will be illustrated by a number of enlarged photographs showing examples of work done.

Institute of Metals

THE Institute of Metals state that they are offering very favourable terms to student members. Among the advantages of student membership are, a reduced entrance fee of one guinea as against two guineas paid by ordinary members, and an annual subscription of one guinea, as against three guineas. Student members may be of any age from 17 to 25, after which time they are transferred to full ordinary membership without payment of any further entrance fee. Application forms are obtainable from Mr. G. Shaw Scott, 36, Victoria Street, London, S.W.1. Another activity of the Institute is the issue of a name and subject index to its *Journal*. Comprising 497 pages, containing over 20,000 references, and covering metallurgical work done between the years 1909 and 1921, the Index Volume is intended to meet the requirements of manufacturers and users of non-ferrous metals and alloys, and to persons engaged in research, teaching, or other spheres of work connected with non-ferrous metallurgy. Copies, at 25s., may be obtained through any bookseller, or direct from the Institute of Metals.

Elephant Brand Heavy Chemicals

A SUBSCRIBER to THE CHEMICAL AGE is anxious to obtain the name of the makers or shippers of soda ash, 58 per cent., light alkali; bicarbonate of soda, mineral water quality; and caustic soda under the trade mark of an oblong border containing the figure of an elephant.

Flash-Point Temperatures of Oils

Their Physico-Chemical Significance

A PAPER describing further investigations into the physico-chemical significance of flash-point temperatures, by Dr. W. R. Ormandy and Mr. E. C. Craven, was read at a meeting on Tuesday of the Institution of Petroleum Technologists.

In a previous paper (*see* THE CHEMICAL AGE, Vol. VI, p. 40) the authors had shown that at the flash-point in air all hydrocarbons possess approximately the same vapour tension; that an increase of pressure raises the flash-points; and that the replacement of air by oxygen lowers the flash-points. For the further investigation of these relations work was carried out mainly on heptane, toluene and ethyl alcohol as representing respectively a typical paraffin hydrocarbon, aromatic hydrocarbon, and an aliphatic alcohol, and the present work divided itself naturally into (*a*) determination of vapour tensions; (*b*) flash-points at reduced or increased pressures; (*c*) flash-points in mixed gases; (*d*) flash-points where vapour-air mixture is further heated.

The authors stated that the accurate determination of the vapour pressure of these bodies at temperatures below 0° C. proved a matter of very considerable difficulty. For higher temperatures the method of Ramsay and Young gave figures in excellent agreement with the results of Young and others on the three bodies mentioned. Below about 5 mm. pressure the method proved very difficult to work. The vapour pressures for heptane and toluene, when compared according to Ramsay and Young's law, agreed to about 0·4 mm.

Dealing with the determination of flash-points under reduced pressure the authors found that at pressures below 200 mm. of mercury the flashes became so weak that definite results could not be obtained. It was also found that the results were to a considerable extent vitiated by the presence of gas in the purified liquids. Thinking that more accurate results could be obtained from the exterpolation of the pressure results the authors showed exterpolated curves of the pressure results for toluene, heptane and alcohol, from which it was seen that the results for toluene and heptane fell in line fairly well with the high-pressure results, but that with alcohol the low-pressure results were too low. The first systematic pressure determinations under pressure were done on toluene, and it was noticed that considerable differences were obtained when different amounts of toluene were taken for the test. In all, 34 flash-points were taken on toluene, and the results were found to fit the formula

$f = 36{\cdot}9 \log. P - 97{\cdot}6$ Where f = flash-point in °C. and P = total pressure in sum. Hg.

The mean divergence of the observations from this curve was 0·6° C. Pressure-flash-point curves were taken on other liquids fractionated to a high degree of purity in the ordinary way. After " de-gassing " the flash-points were found to be much higher.

A number of tables and graphs were then given showing the results of determinations of flash-points in mixed gases. In the case of alcohol and carbon-dioxide-oxygen mixtures some trouble was experienced owing apparently to the solubility of CO_2 in that liquid. It was found necessary to allow the alcohol to become saturated with the CO_2 under its partial pressure in the mixture. At low oxygen concentrations, however, the results obtained were slightly irregular. Some experiments were also made with various types of apparatus in order to determine the effect of increasing the temperature of vapour-air mixtures. It was found that very much weaker mixtures would ignite at higher temperatures than at room temperature. The authors concluded that it was difficult to form any quantitative theory connecting the various factors which determine the lower and upper explosion limits and that such determination depends to a very large extent on the apparatus used.

Cultivation of Indigo in India

ACCORDING to a report on the indigo crop of the Bombay Presidency for 1922–1923, the total area under indigo amounts to 11,100 acres, a considerable expansion of areas having taken place in the Native States. The total acreage of the United Provinces is 38,363, a decrease of 6,207 acres as compared with the previous year. The estimated output for the Bombay Presidency is 1,900 cwt.

The Society of Chemical Industry

Four Papers Before the Manchester Section

Four Papers of great interest were read at the meeting of the Manchester Section of the Society of Chemical Industry on Friday, January 5, and summaries are published below. Dr. E. Ardern presided.

1.—Patents for Chemical Products

By Ernest F. Ehrhardt, D.Sc., B.Sc., Ph.D.

Dr. Ehrhardt said that until recently in this country there had always been room for difference of opinion as to whether valid Letters Patent could be granted for a new product, so as to enable the inventor of a new product to prevent any subsequent inventor, who devised a different process for making the same product, from carrying out his subsequent invention. There had been a swing of the pendulum going on for many decades, if not for centuries, with reference to this point. It might be thought that the 1919 Act settled the matter, but the paper was an attempt to show some of the uncertainties it had introduced.

The expression used in the original Patent Act, the Statute of Monopolies, "Any manner of new manufacture," was at first taken to refer to the article manufactured even to the exclusion of new processes of manufacture. Later, the opposite view was held, and any time during the last twenty years one could have found leaders at the Patent Bar some of whom would have given the opinion that there could not be a product claimed in the above sense, while others expressed the opposite view. The state of the law as applied to patents for coal tar colouring matters could well be seen by considering the judgment of Mr. Justice Wills in the case of Monnet *v.* Beck, R.P.C., Vol. 14, page 843. In the Patent under discussion in that case the third claim was—

> As new products the colouring matters or dyes hereinbefore called anisolines obtained substantially in the manner set forth.

Mr. Moulton, as he then was, argued that the claim should be read as if it were—

> As new products anything identical with the substances produced by my process, no matter by what process obtained.

The Judge did not accept this construction of the claim, but decided that it was confined to colouring matters obtained by the process described, but then went on to say—

> I decide this question as to the third claim not on the ground that there could not be a patent for all anisolines as new things, but adopting the words of Cotton, L.J., in Vorwerk *v.* Evans, 7, Patent Reports, 265–271, that, having regard to the whole of this specification, it is not a claim to anisolines only, but to those made in the way pointed out by the specification.

This case showed that Mr. Moulton not merely submitted that there could be a claim for a chemical product which would cover that product, however obtained, but even argued that Monnet's third claim was such a claim in spite of the restriction, "obtained substantially in the manner set forth." The Judge decided that this restriction narrowed the claim, so that it did not carry the invention beyond the process claims, but he particularly stated that he did not decide that there could not be a patent for all anisolines as new things. Therefore, in 1897, the point was regarded as quite an open one.

There was apparently no attempt by the Courts or the Legislature to settle the question until the New Patent Act of 1919 came into force. Section 11 of that Act was apparently intended to settle the point; there was inserted in the Principal Act a new Section 38a, which opens as follows:—

> In the case of inventions relating to substances prepared or produced by chemical processes or intended for food or medicine, the Specification shall not include claims for the substance itself, except when prepared or produced by the special methods or processes of manufacture described and claimed, or by their obvious chemical equivalents.

The results of this alteration of the law had been curious, and some of them had not been intended by those who suggested the amendment. The doctrine of Heath *v.* Unwin was definitely made applicable to the product claimed or chemical patent; *i.e.*, it was decided that the change of a process by substituting for "carburet of manganese" a mixture of "oxide or manganese and tar" did not constitute an infringement of the "carburet of manganese" process patent, because it could not have been foretold with certainty at the date of the Specification that the tar and managnese oxide would have acted in the same way as the "carburet of manganese."

In further elaboration of the point, Dr. Ehrhardt referred to the Sulphur Black case—Act Ges, für Anilin Fabrikation *v.* Levinstein, Ltd. The defendants, instead of using dinitrophenol, as claimed, used sodium dinitrophenolate, and the Court decided there was no infringement. The doctrine of Heath *v.* Unwin now became applicable to product claims, because a claim to a product had to be restricted to the special process by which the new product was obtained. In the new section substances prepared by chemical processes were coupled together with substances intended for food or medicine, and the same alteration in the law was made with reference to specifications relating to inventions of these three classes—food, medicine, products of chemical processes—and so a decision on a food patent interpreted the law as to products obtained by chemical processes.

2.—Electrolysis of Acetone Solutions of Potassium Chloro- and Tri-Chromates

By E. F. Morris, M.A.

Mr. Morris said that the solubility of potassium chlorochromate in acetone, noted during attempts to synthesise the chromium analogues of sulphonates, evoked interest in the nature of the solution. Acetone dissolves potassium chlorochromate easily, the solutions being electrolytic. Using solutions in acetone from the bisulphite compound with a porous partition and platinum electrodes, a deeper coloured solution, free from potassium is obtained along with a green solution, resulting from the complementary reduction. With less pure acetone the reduced chromium is apt to precipitate as an impure green oxide, blocking the cell and stopping the electrolysis.

The method of preparing the chlorochromate was explained and also the drying operations of the crystals and the acetone. Similar details were given regarding the preparation of potassium trichromate.

Both the new chromium oxidants react with organic substances usually more resistant to oxidation than acetone on mixing their acetone solutions. On evaporation the product from chlorochromate becomes insoluble, although the analysis remains close to that for $ClCrO_3$. This behaviour suggests that the solute is an association of $ClCrO_3$ with acetone dissolved in acetone.

There is an obvious formulation for such an association by attachment through the carbonyl group; a similar arrangement may be postulated for the potassium salts. For magnesium this would entail a doubled molecule, certainly indicative of increased electric resistance.

Reactions with most amines disclose nothing as to the constitution of these salts in solution; analine and aromatic amines generally cause oxidation as does also ethylamine. Ammonia gas passed through the cooled potassium chlorochromate solution produces mixed neutral chromate, the water being abstracted from the acetone. Amido-chromate was not obtained.

Quinoline reacts smoothly without apparent oxidation; the result was so curious that further work is desirable before any statement is made. The calculations for the behaviour of conducing acetone solutions as a reversible engine acting by means of a semi-permeable membrane can be more rigidly applied than for solutes in water. To enable the calculation to be made, it is usually assumed that the solvent can be taken as *per se* identical inside and outside the membrane as a working substance. It is common knowledge that th conductivity of water itself is varied by the dissolved electrolyte; the assumption is therefore not valid however useful.

With acetone this assumption of identity is more probable, so that accurate prediction of the variations of conductivity, vapour pressure, etc., should be practicable. They would be more convincing if rigidly deduced from a theory of solutions before the experimental figures are known.

The powerful reducing action in acetone electrolysis is illustrated by means of a chlor-sulphonic acid solution; free sulphur crystallised out on the electrode and by-products were obvious. The writer has not measured any of these conductivities.

3.—Recent Developments in Chemical Plant

By A. B. Scorer, M.I.M.E., A.M.I.E.E.

The author described the progress made in the manufacture of apparatus in high silicon irons as having been fairly rapid of late years. The problem was now better understood, and it was possible to manufacture parts which are more severely stressed and larger than those previously attempted.

In apparatus, such as centrifugal pumps, great progress had been made, and they could now be manufactured in acid resisting material to work under onerous conditions. The details of a pump made in "Meldrum" Acid Resisting Metal complied with the following conditions—equivalent height of lift 100 ft.; gallons per hour 4,500; specific gravity 1·7; necessitating an impellor 13 in. diameter, running at 1,400 r.p.m. This gave a peripheral speed over the tips of the impellor of 80 ft. per sec. The peripheral speed was considerably higher than it was usual to run pumps of this metal. The shaft was cast along with the impellor head, as owing to the extreme hardness of the material it was not possible to attach the shaft by screwing it into the head.

To avoid any bending stresses on the pump shaft it was driven through a flexible coupling of the pin type, the holes in the pump half of the coupling being bushed with rubber. The driving pulleys were mounted in a separate steel shaft running through in ball bearings.

An improved apparatus for effecting more intimate contact of gases and liquids and promoting better purification was also described, particularly in regard to the washing of gas.

The mechanism was made in three parts, one central piece for lifting the washing medium, and a set of beaters for atomisation, all of which were castings.

The central piece consisted of an inverted cone in which were cast four vanes. The vanes run spirally from the bottom to the top of the cone, and formed virtually a low lift centrifugal pump. The washing medium lifted by the cone was sprayed radially through the perforated cone. The atomiser consisted of two sets of fingers bolted to the dome and these moved at right angles to the sprays from the cones.

The atomising apparatus operated in a circular casing which was made generally of cast iron and consisted of a number of super imposed compartments. In each compartment one of these devices was placed, all being fitted on a central shaft. The lower portion of the cone or pump was immersed in a reservoir of water or any other washing medium formed by the bottom of each section. Each section had a gas inlet to admit the gas from the section below it as well as a water overflow, which maintained a constant level in the reservoir and passed the washing medium to the section immediately below it.

This type of washer had 6, 7 or 8 sections in which the particular device was attached. The shaft was operated through bevel gearing, and at the designed speed the cones began to suck up the water or other medium from the reservoir below and deposited same into the perforated domes or first atomisers. The water was formed into fine sprays in passing through those domes and was sent out by centrifugal force towards the inside walls of the washing section; as it was travelling outwards towards the inner walls of the section it underwent a very perfect atomisation by contact with the revolving beaters, or secondary atomisers which extended from the first atomising dome. By that means the small streams of washing medium issuing from the first atomiser were broken up again into still smaller portions, filling the washing chamber with a complete mist or fog, through which the gas had to pass on its travels from one washing chamber to another.

The advantages of the apparatus were as follows:—

(1) It picked up the washing medium at the centre of the gas washer and by the aid of the specially designed reservoir kept the medium in constant circulation, preventing stagnant liquors.

(2) The atomisation of the washing medium into a fine mist provided the most intimate contact with the gas and prevented any possibility of gas slip.

(3) The volume of the washing medium actually in use was circulated 6 or 8 times more than any other system. It was only by passing and re-passing the washing material in the finest state through these gases, that the impurities and by-products were recovered.

(4) A very strong liquor was obtained as very efficient washing was maintained with a very small flow of washing medium through the machine.

4.—The Effect of Metallic Salts, Soap and Starch upon the Tensile and the Ripping Strain of Cotton Fabrics

By J. Huebner, M.Sc. Tech., F.I.C. and V. Malwin, M.Sc. Tech.

In this paper it was shown that the tensile test alone did not give a complete record of the nature of the changes which occurred in a cotton fabric during scouring and bleaching The ripping test provided additional useful information, but the tensile strain and the ripping strain were not directly comparable.

In order to ascertain the action of salts and other agents upon the strength of cotton fabrics, the tensile strength has hitherto been exclusively employed. It seemed, therefore, of interest to investigate the effect of various salts, of starch, and of soap upon both the tensile and the ripping strain. A very high-class cotton fabric, made from Sea-Island yarn, was used in all the experiments. The effects of various methods of bleaching upon the tensile and the ripping strain of this fabric had already been fully investigated, and it was, therefore, decided to use the fabric in the scoured condition. For the first series of experiments, strips of the fabric were impregnated with one per cent. solutions of the salts and the excess of liquid was removed by passing the strips through a water mangle under uniform pressure. Some of the strips were tested immediately after water-mangling, i.e., wet, whilst others were dried in an air-drying chamber at about 20° C. for a week. The latter were referred to as air-dry. Further tests of strips were dried at 100° C. for two hours and at 120° C. for one hour, respectively, and exposed to the air for 48 hours before testing. All the results had been calculated in per cent., taking the tensile strain and the ripping strain of the original scoured fabric, in the air-dry condition, as 100.

As was well-known, the tensile strain of a wet fabric was distinctly higher than that of the air-dry fabric, and the effect of drying at 100° C. for two hours and at 120° C. for one hour respectively was negligible. The ripping strain of the wet fabric was, however, distinctively lower than that of the dry fabric, and that of the fabric dried at 100° C. was a little lower than that dried at 120° C. Bearing in mind the irregularity in structure of even the most carefully made fabric the differences were, however small, and may, therefore, be left out of consideration. Testing of the wet fabric was only carried out in six experiments because the results did not provide any useful information.

A one per cent. solution of most of the salts was used. The tensile strain of the fabric was slight but a distinct weakening of both warp and weft was produced by calcium chloride, of the weft by zinc chloride and of the warp by boric acid after drying at 120° C. Borax, after drying at 100° C. affected the warp more strongly than the weft, whilst sodium phosphate, after drying at 100° C. and 120° C. respectively, slightly increased the tensile strain. Both starch and soap decrease the tensile strain slightly.

The effect of 1 per cent. solutions of calcium chloride and magnesium chloride, in regard to the ripping strain, was negligible, and that of zinc chloride on the weft was very small. There were only two cases, *i.e.*, boric acid, after drying at 120° C., and sodium stannate, after drying at 100° C. and 120° C. respectively, in which the decrease in ripping strain was very marked. Starch in the air-dry condition, and after drying at 120° C. respectively, increased the ripping strain, but drying at 120° C. brought it practically back to normal. The increase of the ripping strain of the fabric impregnated with a solution of soap was very marked. The highest point was reached after drying at 100° C., and even after drying at 120° C. it was still about 30 per cent. higher than that of the original fabric.

The effect of saturated solutions of the salts was very marked for both tensile and ripping strains.

Industrial Applications of Micro-Organisms

A Proposed Institute of Micro-biology

MR. A. CHASTON CHAPMAN, F.R.S., President of the Institute of Chemistry, presided over a joint meeting of the Biochemical Society and the London Section of the Society of Chemical Industry on Monday, when a discussion on "Micro-Organisms and their Application to Industry and Research" was held.

The CHAIRMAN said that no one who had compared nature's synthetical methods with those adopted by even the most expert organic chemist in the laboratory or in the factory could fail to have been struck with the beauty and efficiency of the former and with the comparative inefficiency and clumsiness of the latter. By a closer study of the way in which the living cell performed its remarkable feats of building up and breaking down, the chemist might hope in time to usher in a new era in industrial organic chemistry. To this end intensive study of the phenomena of colloidal chemistry and of the nature of enzyme action (including the function of "activators" and "accelerators") became of the highest importance. This aspect of the matter had been dealt with in two suggestive presidential addresses, that of Sir William Pope to the Society of Chemical Industry in Montreal, and that of Dr. M. O. Forster to the Chemistry Section of the British Association in Edinburgh. It was also the underlying *motif* of his own recent Cantor lectures on micro-organisms and some of their industrial uses. In those lectures he dealt at some length with a number of industrial processes in which micro-organisms were the active agents. He referred, for example, to the production of glycerin on a large scale during the war by the fermentation of sugar, and to the use of moulds for the saccharification of starch, with special reference to the large scale production of alcohol. He also dealt with the manufacture of vinegar and of lactic and butyric acids by fermentation processes, and to the biochemical production of citric, pyruvic and fumaric acids, the bacterial production of acetone and butyl alcohol, and the importance of micro-organisms in agriculture, in the dairy and in connection with the treatment of sewage. With the exception of brewing and distilling and—in a lesser degree—vinegar making, these and other biochemical industries had until within the last few years received comparatively little attention at the hands of technologists in this country, and their condition had undergone very little improvement since they came into being. It was no exaggeration to say that biologically the vinegar industry was where Pasteur left it, and that minor biochemical industries, such as the production of lactic and butyric acids, were in a still worse position.

Fermentable Sugar from Cellulose

Owing to the lack of co-ordination in research a combined attack on any of the big problems calling for solution was rendered very difficult. Among these might be mentioned the production, by purely biological methods, of fermentable sugar from cellulose, with the enormous influence which such a process would have upon the production of alcohol for industrial and power purposes. Another was the building up, through the agency of micro-organisms, of protein and fat (to be used for food purposes) from inorganic nitrogen and cheap carbohydrate raw materials. He was hopeful that one outcome of this discussion might be a general expression of opinion, perhaps culminating in a formal resolution that the formation of an Institution of Micro-biology was of great importance in the national interest. Such an institution should be a separate national body, and not a mere department of some existing institution.

Sir WILLIAM POPE, F.R.S., said that since organic chemistry consisted so largely in the attainment of the same object as was achieved by living matter, it was surprising that so little interest had been evinced in bacterial chemistry by organic chemists. This appeared the more surprising on reflecting upon the startling advances which had been made by the few chemists who had studied the purely chemical aspects of bacteriology. The discovery made by Buchner that alcoholic fermentation was due to the action of a non-living enzyme, and proceeded in the absence of living matter, showed that the chemical operations of the organism belonged to pure organic chemistry and that the living matter was in a manner merely an accompaniment; in fact, it was seen that all the chemical concomitants of biology belonged to organic chemistry, considered purely as a laboratory science, and that the only real puzzle connected with the study of living matter was associated with the phenomena of growth. It was interesting to note one difference in kind between the operative methods of man and of the micro-organism. With us the conception of a scheme of manufacturing operations was always followed by a lengthy discussion of ways and means in which the provision and cost of high potential energy played a leading part. The energy utilised in the manufacturing operations of the lower organisms, however, was omnipresent; any amount of the low-potential solar energy was available without cost.

Utilisation of Fermentation Processes

Many directions could be indicated in which fermentation processes might be utilised more profitably than at the present in chemical manufacture. It was known that glucose could be converted into more than one-half its weight of citric acid by the fermentative action of several species of *Citromyces*. Considerable quantities of fermentation citric acid had been on the market for many years past, although the working details of the fermentation process were not yet public property. In the citric acid fermentation of glucose carbon dioxide was evolved, and the steps which led to the final product were somewhat complex; the six carbon atom chain of normal hexane present in glucose became converted into the isomeric chain of a secondary hexane during the process. It might be surmised that glucose was first converted into a compound containing five atoms of carbon in the molecule, and that some kind of condensation took place as a secondary reaction in which the branched six carbon atom chain of a secondary paraffin was generated and appeared ultimately as citric acid. This subject still awaited investigation by the chemist. The recent war gave a stimulus to biological methods for producing several important raw materials; the manufacture of fermentation acetone was installed and would probably become an established industry if the butyl alcohol simultaneously produced could be better utilised. A fermentation process for making glycerin was also developed in Germany by which about 1,000 tons per month were made in a yield of 25 per cent. on the weight of the sugar used. Other organic compounds, such as pyruvic and fumaric acids, could be obtained in good yields by fermentation processes and should lead to commercial propositions so soon as outlets for the products become available. It was to be hoped that the attention now being given to the utilisation of cheese whey would result in the economic production of lactic acid in this country. The most useful end to the present discussion would perhaps be a united effort by the Society of Chemical Industry and the Biochemical Society to secure the establishment, with adequate financial and executive resources, of an Institute of Industrial Micro-biology, and he would like to put that suggestion to the meeting as a resolution.

Biologically Induced Reactions

Professor F. GOWLAND HOPKINS, F.R.S., said he wished to emphasise the great variety of chemical reactions which could be induced biologically. It was also of importance to consider certain relations between the growing organism and its medium. It was remarkable how very few of the chemical events involved occurred in the medium itself, and that fact made certain considerations of importance, some of which had not received sufficient attention in the literature. There were some bacteria which contributed few products of any importance to the medium, and they were, of course, only of small use to the chemist, unless by processes of education these bacteria could be taught somewhat different habits. It was, however, a point of some importance to remember that this type of organism was one which was capable of very active oxidation, and if educated could be among the most useful of all. In all the classical fermentations the products accumulated freely in the medium, but although many of these products were true end products, they were also really intermediate products which during the progress of change re-entered the

cell to supply further reactions. These intermediate products might be of greater use to the chemist than the end-products themselves, and it was necessary to learn how to deal with them in fermentation processes and to arrest the action at the right moment. He was in full sympathy with the Chairman's suggestion as to the establishment of an Institution.

Use of Dead Organisms

Professor A. HARDEN, F.R.S., said the actions with which he was most familiar were the actions of sugar, and he thought it was not too much to say that although the end products were largely different in the different cases, yet in the process of chemical change they had all passed through some common stage. The latest work had been done by Professor Gray, and from this it appeared likely that the sugar undergoes one of three changes. Some of it was converted into lactic acid, some of it was probably converted into an intermediate product, very likely acetaldehyde, and some of it was converted into formic acid. The work that had been done so far rather showed that there were only two or three fundamental ways of attacking the sugar molecule. It was also interesting to note that some light might be thrown on the action that goes on in cells of higher organisms by the study of these micro-organisms, quite apart from being useful in leading us directly to industrial processes. There was also another possibility, and that was the use of dead organisms instead of living organisms. If they could use dead organisms, they got rid of the trouble introduced by the growth of the organisms, and of the expensive nourishment which the organism devoured, and generally simplified the whole problem. He also supported the proposal to form an Institute.

Decomposition of Cellulose

Sir JOHN RUSSELL, F.R.S., said that of the various ways in which micro-organisms come into play in agriculture, the simplest were those in which the carbo-hydrates were involved, such as in dairying for the proper production of butter and cheese. An even more important set of decompositions, however, was the decomposition of cellulose, and it was important to remember that cellulose was by far the cheapest raw material on the farm. Experiments had been carried out at Rothamsted in the decomposition of straw, and it had been found possible to obtain a gas containing about 90 per cent. of methane and 10 per cent. of hydrogen. It was possible to obtain 6 or 7 cu. ft. of this gas per day from a ton of straw. The process was actually being operated practically at one house in the country—Burford Court—where the inflammable gas so produced was used for heating purposes. Whilst it was also possible to obtain hydrogen, the process was not anything like so rapid, the rate being only one-thirtieth the rate of production of methane. There was another fermentation of cellulose which occurred under aerobic conditions—the gas production was under anaerobic conditions—and that was a fermentation which gave rise to the black sticky substance which they were all familiar with in well-rotted farmyard manure. This production of humus was of very great importance, and the process was being worked now in practice for the production of artificial farmyard manure.

Professor H. E. ARMSTRONG, F.R.S., said he thought the establishment of such an Institute as had been foreshadowed would have the effect not of spreading the study but of centralising it too much, and before anything was done in that direction they should do something to make the existing institutions more fruitful. The institution he would first like to see established in this country was an institution which would house chemists and bring them together in one body and give them a place in the eyes of the public. Until chemists learned to speak out and assert themselves they would not be doing their duty either to themselves or to the public.

Dr. PICARD spoke of the methods of treating leather, in the skins, before and after they come into the tanning yard, and Mr. A. K. BOLTON made a few remarks upon the margarine industry. Other speakers were Dr. TEISEN, who drew a distinction between biochemistry and microbiology, and Mr. O'SHAUGHNESSY, who referred to experiments at Birmingham with the object of securing a better effluent from sewage.

The CHAIRMAN, at the conclusion of the discussion, put the motion by Sir William Pope with regard to the proposed Institute, and it was carried with one dissentient, Professor H. E. Armstrong.

Demand for Nitrate of Soda

Further Important Purchases by German Importers

IN their fortnightly nitrate circular, dated January 4, Aikman (London), Ltd., state that arrivals since December 19 last amount to about 47,000 tons, and about 50,000 tons are due during the next fortnight. The market has been extremely active throughout the fortnight, with a large demand from consumers in practically all consuming markets, and a steady improvement in prices has resulted.

Important transactions in cargoes and liner parcels were reported at 12s. 6d. up to 12s. 10½d. per cwt., c.i.f. for November-December sailings, and at 12s. 6d. to 12s. 7½d. per cwt. c.i.f. for January-February shipment by liner. Prices in European consuming markets have also advanced to the parity of £12 15s. to £13 10s. per ton delivered according to market, at which prices consumers have been buying freely. An enormous business has been done by the producers' Association during the fortnight, amounting to about 272,000 tons, making the total sales for shipment after July 1, 1922, about 1,492,000 English tons, of which 1,344,000 tons are for shipment up to April, 1923, and 148,000 tons for shipment in June, 1923.

Good American Demand

The features have been further important purchases by German importers, the disregard by consuming dealers of the fluctuations in continental currencies, and a general disposition on their part to contract for next spring delivery on a sterling basis. The re-entry of Germany as a buyer again through the old channels may have far-reaching consequences to the industry. In the United States the demand is also reported good, and a tender called for by the American Government for 25,000 tons ex their reserve stock of 150,000 tons resulted in bids for over 100,000 tons, those accepted ranging from $4.60 to $5.20 per 100 lb. in store. A tender for a further 10,000 tons has been called for the middle of this month.

Visible Supply Position

The summary of the visible supply position as at December 31 last, is rectified as follows (in tons) :—

	1922.	1921.	1920.	1913.
Europe and Egypt	452,500	903,500	782.000	1,098,000
United States ..	202,000	251,000	132,000	71,000
Japan and other countries ..	29,000	19,000	17,000	18,000
Stocks in Chile ..	1,208,000	1,449,000	1,304,000	498,000
	1,891,500	2,622,500	2,235,000	1,855,000

Including all sales by the Producers' Association up to date the quantity sold and not shipped at January 1, 1923, for shipment January-April, 1923, is estimated at 225,000 tons for Europe, 190,000 tons for the United States, and 40,000 tons for other countries.

Freights have been firm, and numerous steamers for February loading have been fixed for Europe at 32s. 6d. up to 37s. 6d. per ton for small size, and liner space for January-March loading has been done at 32s. 6d. up to 36s. 3d. per ton.

In their annual report the firm state that the past year has been a lean one for producers of nitrate owing to the delivery of old high-costing stocks at the current level of price and to the heavy cost of stoppage expenses incurred. They point out, however, that with the big reduction in the world's stocks and the probability of an increasing consumption, the future outlook is much more favourable, and a general reopening of oficinas in the second half of this year may be expected. The fall in the price of oil, coal, bags, and other articles used in manufacture, together with the cheapness of labour owing to the low Chilean exchange has reduced the cost of production, which now ranges from 5s. 9d. to 7s. 6d. per quintal. Fifty oficinas are now working, as compared with thirty-four at this date last year, and several others are about to reopen. A feature of the year has been the re-establishment in Europe of a free market, and there have been more dealings in cargoes and liner parcels during the past few months than in the previous four years. The nitrate " pool " was finally dissolved at the end of July, and it is largely owing to this fact that a more active market has again been established.

American Dyestuffs Manufacture

Need of New Analytical Methods

In the portion of the annual report of the American Bureau of Chemistry dealing with colour investigations it is stated with regard to indigo that the process at present in use in the U.S.A. has been not altogether satisfactory, and an investigation was undertaken with a view of substituting an alternative method for the preparation of this dye. A survey was made of the entire process, and the results obtained indicate that indigo of good quality can be obtained at a somewhat lower price than is possible by the method now in vogue. A new dye, similar in dyeing properties to indigo, has been made from cymene—a waste product obtained in the preparation of paper pulp from certain resinous wood.

A relatively simple method was worked out for making anthraquinone from anthracene, using the oxygen of the air instead of the rather expensive chemicals heretofore used. A public-service patent was granted on this process.

Although "vital red" is used in only small amounts, it is considered to be of tremendous importance both in time of peace and in war. Medical men have been unable to secure the dye, which they use for testing blood volume, in the U.S.A. in satisfactory quality and accordingly a complete study of the method of preparation was undertaken. Several batches have already been prepared and submitted to expert medical investigators for examination. Work on this dye is being continued.

Detection of "H" Acid

The opinion is expressed that the greatest need of the American dye industry is the discovery of better methods of analysing dyes and intermediates. Work along these lines was undertaken, and a new method was devised for the detection of "H" acid.

As no reliable data were available on certain physical measurements of the more important intermediates, work was undertaken for their determination. Vapour pressure measurements were made on naphthalene, anthracene, phenanthrene and anthraquinone. The solubility of certain naphthalene sulphonic acids which are used in the dye industry was determined.

A chemical study of the pre-war German biological stains and of the American product which is being manufactured to take their place was undertaken, with rather unsatisfactory results in some instances. It was found that certain American stains were equal to the pre-war German stains, whereas others were unsatisfactory. The methods of preparing these stains are being thoroughly investigated, and an effort is being made to standardise the methods of preparation so as to obtain a uniform product.

Coal Treatment Processes

The registration of the Minerals Separation and Powell Duffryn Coal Treatment and Briquetting Co., Ltd., as a private company with a nominal capital of £10,000 in £1 shares, recalls the issue of a report by the directors of Minerals Separation, Ltd., last July, in which it was stated that research work in connection with the company's coal processes had been continued, with the result that further important improvements had been evolved, and that the advantages claimed for the new briquetting system had been conclusively proved. At a meeting which was held later it was announced that the company, in conjunction with the Powell Duffryn Co., had acquired a site in Wales where a plant would be erected to produce at least 2,000 tons of "Minsep" patent fuel daily.

Manufacture of Wood Extracts

Following the policy of joint conferences, which have been so successful in the past, the chairman of the Chemical Engineering Group, Mr. J. Arthur Reavell, M.I.M.E., will read a paper before the Hull Chemical and Engineering Society in the rooms of the Hull Photographic Society on Tuesday, January 16, on "The Manufacture of Wood Extract." The Group Committee have been asked by the Hull Committee to extend to members of the Group a very cordial invitation to attend the meeting if possible and endeavour to make the gathering a joint success. The paper promises to treat the subject comprehensively, and it will be well illustrated by slides.

Unsuccessful Manufacture of Celluloid

The creditors of the Tomseloid Manufacturing Co., Ltd., Abbey Road, Park Royal, London, and Cowley, Middlesex, celluloid manufacturers, were called together on January 3, at the offices of Mr. D. Sunderland, 15, Eastcheap, E.C. Mr. Sunderland, the liquidator, submitted a balance sheet which showed liabilities of £9,395 1s., made up as follows:—trade creditors £1,076 13s. 8d., bank overdraft £5,131 15s., cash creditors £2,500, directors' fees £241 13s. 2d., and rent, rates, etc., £444 19s. There was also a contingent claim for £1,360 10s., which had not been included in the liabilities. The assets were estimated to realise £17,369 9s. 5d. and consisted of: stock at Park Royal £266 6s. 9d.; stock at Cowley £145 16s. 5d.; freehold property at Park Royal, £6,250; plant, machinery, etc., at Park Royal £5,920 17s. 6d.; plant, machinery, etc., at Cowley £4,207 12s. 1d.; instruments £34 12s. 6d.; office furniture £138 5s.; insurance paid in advance £55; book-debts £325 19s. 2d.; and electric light deposit £25. Mr. Sunderland reported that the company, which was incorporated on November 10, 1921, went into liquidation on December 20 last. The company carried on the manufacture of celluloid, and took over a businesss previously carried on at Cowley, Middlesex, and City Road, by Mr. J. Thompson. The trading of the company according to balance sheets prepared for the year ended November 9, 1922, disclosed a total loss of £5,083. The sales for the period were £433 3s. The directors attributed the loss and the smallness of turnover to difficulties of commencing business; a fire at Cowley which seriously interrupted manufacturing process; and inability to deal with one important section of the business, namely, that of producing sheets owing to the lack of a press, for the purchase of which there were no funds available. The directors considered that the initial difficulties had now been got over, and given further capital and some forbearance by the creditors, the company could very shortly be in production upon a profitable basis capable of discharging the creditors' claims at a comparatively early date. A resolution was passed confirming the voluntary liquidation of the company with Mr. Sunderland as liquidator, and an informal committee of the principal creditors was also appointed.

Failure of a Consulting Chemist

Under a receiving order made against him on December 21 last, on a creditor's petition, the statutory first meeting of the creditors of Mr. Samuel Richard Pearson, late of 87, Bishopsgate, London, and of Jewin House, Jewin Street, London, was held on Monday, at Bankruptcy Buildings, Carey Street, London. It appeared that the debtor was undischarged from a bankruptcy recorded against him in 1917. He had since been engaged as a technical chemist, reporting on chemical processes for various persons and firms. The fees he had earned had, however, been insufficient to pay his living expenses. He was the nominal director of a company in which he held 175 shares of £1 each, which had been transferred to the petitioning creditor as against a loan. The debtor was also the holder of a number of other shares which were allotted to him as consideration for an invention for making power gas. He had no other assets other than shares of doubtful value, and said that apart from the liabilities in the previous bankruptcy he owed only £300. He attributed his present position to lack of remunerative employment and to living on borrowed money. The meeting was closed, and the estate remained in the hands of the Official Receiver.

Shipments of Nauru Phosphates

In an appendix to his latest report on the economic situation of Australia, Mr. S. W. B. McGregor states that the British Phosphate Commission made good progress during the first year of its control ended June 30, 1921, when 364,424 tons of phosphate were shipped from Nauru and Ocean Islands, a quantity greater by 25,000 tons than that shipped in any previous year. For the year ending June 30, 1922, the shipments will be about 365,000 tons. During this same period the quantity imported into Australia will be about 175,000 tons. The total quantity shipped during the eighteen months ended December 31, 1921, was 554,656 tons, which was distributed in the following manner:—To Australia, 357,496 tons; to United Kingdom, 32,300 tons; to New Zealand, 29,750 tons; other countries, 135,110 tons.

Arsenic in Cocoa

Summons against Manufacturers Withdrawn

THE Nestlé and Anglo-Swiss Condensed Milk Company, London, were summoned at Guildford on January 5 for selling cocoa which was adulterated with arsenic to the extent of one-fiftieth of a grain per pound.

Mr. R. O. Lane, for the prosecution, said the purchase of half a pound of cocoa was made by an assistant inspector from a grocer's shop. The presence of arsenic in the cocoa was attributable to carbonate of potash used in its manufacture. The retailer was morally guiltless. Correspondence occurred which brought to light the fact that the defendants were not the manufacturers of the cocoa, but Hayes Co., Ltd., from whom Nestlé's Company bought the cocoa under a warranty. He pointed out that the Nestlé Company had taken every possible step to withdraw from sale the batch of cocoa in question, and he asked the Bench that the summons might be withdrawn. Mr. Roland Oliver, for the defendant, said the firm was morally as guiltless as the retailer. It was accepted that one grain of arsenic was a fatal dose. There would not be one grain of arsenic until fifty packets of this cocoa had been consumed, which would mean 5,250 cups of cocoa being drunk.

The magistrates allowed the summons to be withdrawn.

Research on Liquid Carbon Dioxide

THE Liquid Carbonic Division of the Compressed Gas Manufacturers' Association of America announces the establishment of an Industrial Fellowship in the Mellon Institute of Industrial Research of the University of Pittsburgh, for the purpose of classifying, studying and developing the uses of liquid carbon dioxide. The founding of this fellowship is in accord with the desire of the members of the association to co-operate with users and prospective users of liquid carbon dioxide, with the object of developing efficient means of applying the gas and of obtaining fundamental data bearing on its use in various industries. In addition to conducting research work, the fellowship will be made a clearing house of information regarding various uses of liquid carbon dioxide, and data will be kept on file for the accommodation of prospective users of this product. The present incumbent of the Industrial Fellowship is Mr. Charles L. Jones, who will be glad to correspond with anyone interested in the use of liquid carbon dioxide in industry.

Position of the German Chemical Industry

A RECENT report of the Association for the Protection of the Interests of the German Chemical and Dye Industries states that during the first half of the present year conditions were unfavourable to the sale of medicinal products, but improved later. The chemical industry is very hard hit by the provision in the Peace Treaty requiring the delivery of 25 per cent. of the total production of medicinal products and dyes to the Allies, a measure which has a powerful influence on foreign trade. The pharmaceutical industry has suffered greatly through the shortage of glass bottles of all descriptions. The glass works have repeatedly refused to accept orders under the pretext that present orders will take months to complete. Delivery in three, four or even more months could not be guaranteed, and when orders were accepted the acceptance was accompanied by far-reaching limitations. But while the German manufacturers were unable to secure delivery of bottles for their own use, the exports of glassware showed a steady increase every month.

Synthetic Nitrogen in Canada

PLANS are being formulated for the further development of an atmospheric nitrogen products industry in British Columbia. A plant was established four years ago at Lake Buntzen by an American Company, which carried on operations throughout 1920 and a part of 1921. According to *Chemical and Metallurgical Engineering*, operations will shortly be resumed, when a daily output of about five tons of sodium nitrate and nitric acid is expected. The plant will be in operation day and night with a staff of thirty-five men for the present. If results are satisfactory operations will be greatly extended.

Income Tax Deductions

To the Editor of THE CHEMICAL AGE.

SIR,—The Income Tax demand notes now being issued are an unpleasant reminder of the continuing burden of taxation, despite the reduction in the rate of tax. It is essential that taxpayers should carefully verify the correctness of the amount demanded, for it is well known that much overpayment is made through lack of knowledge of the various deductions, allowances, and reliefs which are claimable.

The following are some of the more usual deductions, shortly stated, which the individual taxpayer should check to ensure that he has escaped overcharge, viz., earned income tenth, personal allowance (£225 married or £135 single), wife allowance to £45 on earnings (including value of services in husband's business), children allowance (£36 first and £27 subsequent), housekeeper allowance £45, widowed mother £45, dependent relative £25, first £225 taxable at 2s. 6d., life insurance premiums 2s. 6d. to 5s. per £, wear and tear of plant and machinery, superannuation contributions, expenses wholly and necessarily incurred, employees' earnings on the current year, relief on taxed income, untaxed interest reduction if investment sold.—Yours, etc.

W. R. FAIRBROTHER.

67–68, Cheapside, London, E.C.2.

Reducing Hematite to Magnetite with Methane

DURING recent experiments on the reduction of iron ores with fuel gases carried out at the Pacific Experiment Station of the U.S. Bureau of Mines, Berkeley, California, it was noticed that at temperatures up to 800° C. the methane in these gases was practically inert as compared with hydrogen or carbon monoxide. A number of experiments were then carried out with mixtures of methane and hydrogen over a wide range of temperatures to find out when the methane would begin to function actively as a reducing agent. While it reacted slowly at all temperatures tested, its reaction in the reduction of hematite to magnetite, the first stage in the reduction of iron, did not become sufficiently rapid to be of industrial importance until temperatures of over 900° C. were used. A rough approximation of the velocity constant of this reaction was made for all the temperatures at which tests were made in order to obtain some unit figures of value in designing industrial apparatus for carrying out this reaction. The details of these experiments are contained in Serial 2382, which can be obtained from the Bureau of Mines, Washington, D.C.

Chemical Research at Bangalore

THE researches in progress in the department of general and organic chemistry at the Indian Institute of Science, Bangalore, of which Dr. M. O. Forster is now Director, include the study of mixing moist white lead with oils; purification of common salt; manufacture of sodium dichromate; the equilibrium between chromium oxides and alkalis; manufacture of sodium thiosulphate; production of decolorising vegetable charcoals; hardening of oils; examination of *nim* oil and *nim* bark; examination of the composition of *hongey maroti cashu* nut, etc., oils; lipase method of splitting oils; solubility of barium sulphate in concentrated and fuming sulphuric acid; examination of Indian materials which yield essential oils; production of vanillin from eugenol; catalytic production of ether; manufacture of hydrogen peroxide.

Extraction of Mesothorium

FOR several years after Hayn's discovery of mesothorium, in 1907, its method of extraction was kept a technical secret. But when Soddy and Marckwald a few years later independently established the chemical identity of mesothorium with radium, the trade secret vanished. Evidently the well known methods of extracting radium thereby became standard procedures for the production of mesothorium. Though the chemistry of mesothorium and the methods of preparation are thus clearly defined, its production presents many problems for investigation. Information regarding the extraction of mesothorium from monazite sand is given in Technical Paper 265, by Herman Schlundt, just published by the U.S.A. Bureau of Mines, Washington, D.C.

From Week to Week

ACCORDING to an Exchange message from Carlsbad, the Pilzen Soda Works have concluded a loan of £1,500,000 in England.

HERR STINNES is reported to be contemplating a visit to Rumania with a view to acquiring the bauxite deposits at Jadtale in Transylvania.

A PROPOSAL to manufacture synthetic thymol from cymene, a waste product of the paper industry, is said to be receiving consideration in America.

DR. HUGH S. TAYLOR has been promoted by the trustees of Princeton University to a full professorship in the department of chemistry, with the title of professor of physical chemistry.

OWING to the lorry on which they were loaded having caught fire, a number of cylinders of dissolved acetylene and of calcium carbide exploded on Tuesday in a yard off Old Hall Street, Liverpool.

RHYTHMIC CRYSTALLISATION is the title of a paper by W. E. Garner and F. C. Randall, to be read at a meeting of the Chemical Society, to be held at Burlington House, London, on January 18, at 8 p.m.

AN EARLY RESUMPTION of work is anticipated at the Broken Hill Co.'s Newcastle (Australia) works owing to the termination of the strike against wages reductions which has been proceeding for some time.

SIR ALFRED MOND, M.P., has been appointed to the board of Brunner Mond and Co., Ltd. Sir Alfred, who was formerly a director of the company, relinquished that position on becoming a member of the late Cabinet.

A TENDER of Alex. Cross and Sons, Liverpool, for 30 tons of nitrate of soda required at the chemical works belonging to the gas department, at £14 per tons, has been accepted by the Bradford Corporation Gas Committee.

THE SCIENTIFIC NOVELTIES EXHIBITION at King's College, London, which closed on Wednesday, was visited by over 20,000 people, and the London Hospitals' Combined Appeal will benefit to the amount of nearly £1,800.

A COPY of a list of drugs for the supply of which tenders are being called for by the Ministry of Public Health, Belgrade, may be inspected at the Department of Overseas Trade (Room 53), 35, Old Queen Street, London, S.W.1.

A LIQUID CHLORINE PLANT with a monthly production of 300 tons has recently been completed at the works of the Canadian Salt Co., Ltd., at Sandwich, Ontario, and this product is now being manufactured in the Dominion for the first time.

SINCE 1916 over two lakhs of rupees have been received by the Department of Industries, Bombay Presidency, as royalties for the manufacture of magnesium chloride. Owing to the fall in the price the royalty terms are now under revision on a profit-sharing basis.

A FIRE in the pitch house at Brownhills Chemical Works, Lichfield Road, Brownhills, on January 6, resulted in the destruction of that building although the adjoining buildings were saved. No definite estimate of the amount of the damage is at present available.

ACCORDING TO A CIRCULAR issued by the Potash Syndicate, sales realised by the German potash industry during the past year are estimated at about 13,000,000 doppelzentner. The Syndicate's sales during the previous year are reported to have amounted to 9,000,000 doppelzentner.

IN AN INTERIM REPORT to shareholders, the directors of English Oilfields refer to the disappointing results of the tests of processes outlined in their last interim report. They add that they are at present inquiring into various other processes, as to which they will report more fully at the next general meeting.

IN A DISCUSSION on the pooling of knowledge in the rubber industry, at a meeting of the London Section of the Institution of Rubber Industry on Monday, Mr. B. D. Porritt, said the difficulties experienced in one rubber works were usually common to all. There was, therefore, little to be gained by any undue secrecy.

AN APPLICATION from the employees at the Bradford Corporation Chemical Works to be placed under awards of the Gas Industrial Council, instead of coming, as at present, under the jurisdiction of the Industrial Council for the Chemical Industry, has been refused by the Bradford Corporation Finance and General Purposes Committee.

DR. SAMUEL W. STRATTON, director of the U.S.A. Bureau of Standards since 1901, was the guest of honour at a farewell dinner held at the Bureau on December 14, when he was presented by members of the staff with a silver service as a mark of appreciation of his work. Dr. Stratton is president-elect of the Massachusetts Institute of Technology.

AT THE THIRD MEETING of the Departmental Committee which is inquiring as to the method of charging for gas on a thermal basis, it was suggested that the Fuel Research Board's recommendation that all gas undertakings should have recording calorimeters to ensure continuous testing of heat content should have been incorporated in the Gas Regulation Act.

THE ANNUAL GENERAL MEETING of the Society of Public Analysts will be held at Burlington House, Piccadilly, London, on Wednesday, February 7, at 8 p.m. The ordinary monthly meeting will be held immediately after the annual meeting, when papers on "The Examination of Preserved Meats, etc.," by Osman Jones, F.I.C., and "Titanium in Nile Silt," by E. Griffiths-Jones, will be read.

DR. J. NEWTON FRIEND, head of the Chemistry Department of the Birmingham Technical School, has followed the example set in London of giving holiday lectures on popular lines dealing with scientific subjects for boys and girls, during the school and college vacation. In a series of lectures in Birmingham last week, he gave a simple explanation of the constitution and functions of colloids.

A MEETING of the Society of Glass Technology will be held in the Applied Science Department, The University, St. George's Square, Sheffield, on Wednesday, January 17, at 3 p.m., when the following papers will be read:—"Stainless Steel, with some Consideration of its Application in the Glass Industry," by Dr. W. H. Hatfield; "Some Measurements of the Viscosity of Glasses near their Annealing Points, and a Critical Review of some Recent Literature on the Annealing of Glass," by S. English, M.Sc., A.I.C.

A PRELIMINARY STATEMENT of our overseas trade in December shows that imports into the United Kingdom during the month amounted to £94,911,621, a decrease of £689,000 compared with the previous month. British exports in December totalled £58,883,032, a decrease of some £7,608,000 compared with November. Compared with December, 1921, imports show an increase of £9,547,000, and British exports a decrease of £1,491,000. Re-exports last month were £8,479,066, a decrease of £669,000 compared with November.

IN ORDER TO CELEBRATE the 75th birthday of Professor Paterno, a committee of the Italian Association of General and Applied Chemistry, of which Prince Ginori Conti is the president, is appealing for subscriptions towards a fund for the provision of a Paterno Medal to be awarded each year to the author of the most important chemical discovery in Italy or elsewhere. Professor Paterno, whose services to chemistry are well known, is an honorary Fellow of the Chemical Society. Subscriptions may be sent to Sir William J. Pope at the Chemical Laboratory, the University, Cambridge.

DR. F. G. COTTRELL, acting director of the United States Fixed Nitrogen Research Laboratory, in a report to the Department of Agriculture, states that in the present state of development of processes for the fixation of atmospheric nitrogen in the United States, fixed nitrogen cannot be produced for fertiliser purposes in competition with Chilean nitrate and with ammonia obtained as a by-product in the coking of coal, except under unusually favourable circumstances. Dr. Cottrell adds that there is every reason to believe that the cost of fixation can be materially reduced through further study and development.

DELEGATES from the Standard Chemical Co., of Pittsburg, and of the Radium Co., of Colorado, are paying a visit to Belgium with a view to investigating the radium works established at Oolen, near Antwerp, by the Union Minière du Katanga, and in which radium is manufactured from the ores produced in the Katanga province. As a result of this visit the United States Geological Survey has just published a report on the situation of the radium industry in the United States, from which it appears that the two companies mentioned have decided to give up the manufacture of radium. This is due to the considerable reduction in the price of the substance caused since its manufacture in Belgium.

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Abstracts of Complete Specifications

189,834. DYESTUFFS OF THE ANTHRAQUINONE SERIES, MANUFACTURE OF. A. G. Dandridge, J. Thomas and Scottish Dyes, Ltd., Murrell Hill Works, Carlisle. Application date, August 3, 1921.

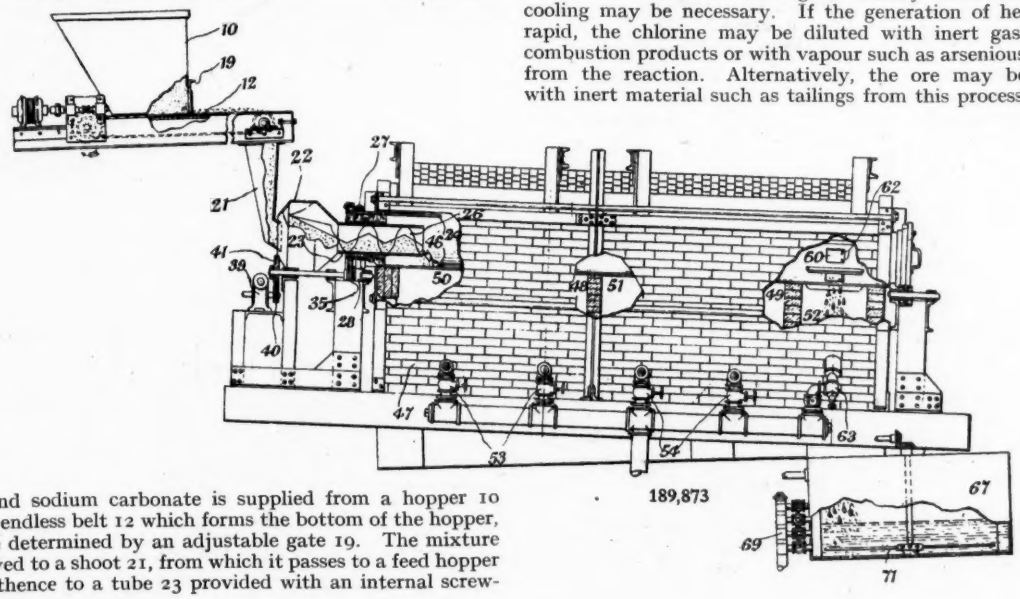
The process is for obtaining an improved yield of N-dihydro-1 : 2 : 2' : 1'-anthraquinone-azine or its derivatives by the addition of inorganic salts which are reducing agents, such as cyanides, sulphides and ferrocyanides of the alkali metals to a fused mixture of 2-amino-anthraquinone and caustic potash. In an example 350 parts of caustic potash are melted and 95 parts of potassium sulphide are added. The mixture is raised to 200° C. and 50 parts of 2-amino-anthraquinone added, and the mixture raised to 220°-240° C. The dyestuff is precipitated by boiling with 2,500 parts of water. It is found that the yield of dyestuff obtained compared with that obtained by fusion with caustic potash alone is in the proportion of 22 to 16.

189,872. TANNING AND OTHER EXTRACTS, MANUFACTURE OF. C. W. Nance, 301, Mansion House Chambers, Queen Victoria Street, London. Application date, September 8, 1921.

The object is to obtain a maximum quantity of tanning extract, and the minimum of colour from the tanning material. The raw material is treated with water under a vacuum of about half an inch of mercury, and at a temperature of about 80° F. The water boils at this temperature, but the resins and colouring matter of the tanning materials are scarcely affected. The material is treated in leaching vats provided with steam-heating coils at the bottom, so that the material may be heated to the desired temperature while under reduced pressure. The liquor from the first vat is then run into a second vat containing tanning material, and fresh water is added to the first vat. The liquor then passes to a third and fourth vat. The strong liquor finally obtained may then be evaporated at a higher temperature in another vat at reduced pressure without injuring the tanning extract.

189,873. TUNGSTEN COMPOUNDS FROM TUNGSTEN ORE, METHOD OF, AND APPARATUS FOR, PRODUCING IN A CONTINUOUS MANNER. The British Thomson-Houston Co., Ltd., Crown House, Aldwych, London, W.C.2. From the General Electric Co. Schenectady, N.Y., U.S.A. Application date, September 8, 1921.

The tungsten ore is crushed and fused with a substance such as sodium carbonate, which converts the tungsten into a soluble compound. This compound is dissolved out and tungstic oxide precipitated by adding an acid. The mixture of ore and sodium carbonate is supplied from a hopper 10 on to an endless belt 12 which forms the bottom of the hopper, at a rate determined by an adjustable gate 19. The mixture is conveyed to a shoot 21, from which it passes to a feed hopper 22, and thence to a tube 23 provided with an internal screw-conveyer 26. The tube 24 is provided with a flange 27 resting on rollers 28 and with similar supporting means at the opposite end, the tube being slighly inclined downwards to the outlet end. The tube 24 is rotated by a motor 39 through gearing 40, 41, 35. The tube 23 rotates with the tube 24, and enables the mixture to be discharged by the conveyor 26. Agglomeration of the material is prevented by a loose chain 46 having one end attached to the screw-conveyer 26. The heating furnace 47 is divided into three chambers 50, 51, 52 by transverse partitions 48, 49 and the chambers 50, 51 are heated by gas burners 53, 54. The chamber 50 is maintained at a very high temperature to convert the mixture into a semi-fluid condition, so that it flows along the tube 24 to the zone heated by the chamber 51, where the temperature is sufficient to keep the mixture semi-fluid and promote the desired reaction. The rear end of the tube 24 is provided with openings 60, and with internal baffles 62 to discharge the fused mixture through these openings. The heat from the gas burner 63 is concentrated on the material which is being discharged to prevent its solidification. The material is received in a tank 67 containing water, which is maintained at the desired level by a valve 69. A rotary stirring device 71 is also provided to facilitate solution of the soluble salts. In an example a mixture of wolframite ore, sodium carbonate and sodium nitrate is treated at a temperature of 980°–1,000° C., yielding sodium tungstate and oxides of iron, manganese, etc The continuous delivery of the fused material into water facilitates its disintegration and solution, and a solution of sodium tungstate is readily obtained.



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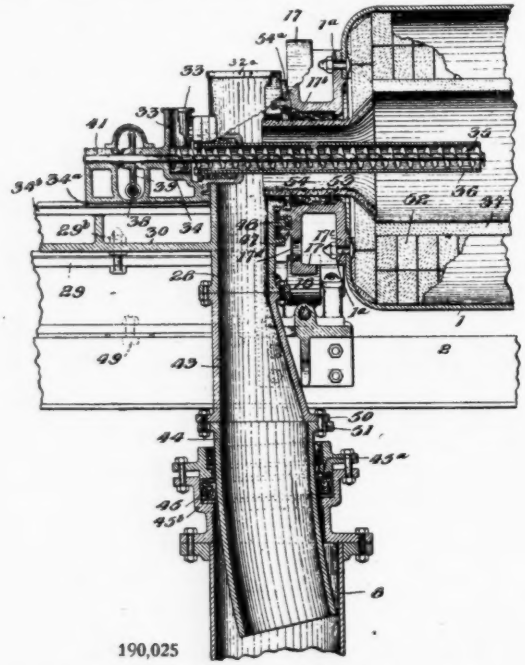
190,025. ARSENICAL ORES AND MATERIALS, TREATMENT OF. R. Haddan, London. From Metallurgical Development Corporation, 110, Brookline Avenue, Boston, Mass, U.S.A. Application date, January 3, 1922.

Arsenical ores or concentrates which contain cobalt, nickel, silver, copper, iron, etc., are treated with dry chlorine at a temperature up to 600° C. The iron and arsenic are volatilised as chlorides, and may thus be separated. The ore is finely ground so that at least 95 per cent. passes through a 100-mesh screen, and this is readily acted upon by dry chlorine free from air. The action of the chlorine is highly exothermic, and the heat developed is relied upon to maintain the necessary temperature, but it is necessary to prevent fusion or sintering, and to maintain the porous character of the ore. The chlorination process is preferably carried out in a counter-current apparatus such as a rotary kiln or shaft furnace, which enables the temperature to be controlled. The furnace is lined with refractory material, and slightly reduced pressure is maintained within it. External heating is usually unnecessary, but cooling may be necessary. If the generation of heat is too rapid, the chlorine may be diluted with inert gas such as combustion products or with vapour such as arsenious chloride from the reaction. Alternatively, the ore may be diluted with inert material such as tailings from this process, or with

poorer ores. The temperature is maintained between 400° C. and 600° C., at which arsenic and iron chloride volatilise, but nickel, cobalt and silver chlorides do not. The ferric chloride and arsenious chloride, together with any sulphur or antimony chloride present, may then be condensed and separated by redistillation. If the chlorine used is free from air, the production of ferric oxide, which is non-volatile, is avoided, and also the production of arsenious oxide. The use of cell gas from chlorine-caustic cells is usually satisfactory. The



190,025

calcined material is treated with sufficient water to produce a hot saturated solution of chlorides, including silver chloride. The solution is separated, and diluted to precipitate silver chloride. Alternatively, a larger proportion of water may be used, which leaves the silver chloride undissolved, and it may then be recovered by solution in sodium thiosulphate or cyanide. The mixture of cobalt, nickel and copper chlorides may be separated in the usual manner. The process may be modified by first chlorinating at a temperature of 250° C. to remove the arsenic, and then at a higher temperature to remove the iron. It is found that the presence of calcium and magnesium carbonates in the ore causes sintering, so that these are preferably removed by preliminary treatment with acid. If hydrochloric acid is used, any basic or other oxides are also dissolved, as well as some nickel, cobalt and copper. The recovered arsenious chloride may be hydrolysed to precipitate white arsenic, and the liquor containing hydrochloric acid may be used for extracting calcium carbonate from the original ore. The liquor is thus partly neutralised, so that any arsenic it contains may be recovered by a further addition of calcium carbonate. Alternatively, the arsenious chloride may be treated hot with water and chlorine, yielding a solution of arsenic acid and hydrochloric acid vapour.

The illustration shows one end of a rotary drum 1, in which the ore is chlorinated. The mixture is supplied from a hopper 33 and is conveyed to the reaction chamber 37 by a screw conveyor 35, which is driven by worm gearing 38, 39. The inlet casting is formed with a guide 34a, which is free to move longitudinally on a guide way 34b, carried by the main casting 28. Chlorine gas for the reaction is introduced at the opposite end of the chamber, and volatile chlorides pass through the annular conduit 54 to a curved pipe 44, which projects into a larger pipe 8, leading into the condensing apparatus. The pipe 44 projects through a packing 45 so that the frame 2 may be raised to alter the inclination of chamber 1. A gas-tight connection between the rotating chamber 1 and the casting 28 is secured by the provision of a series of concentric packing rings 47. A bearing ring 17 is provided to rotate on rollers 18; the reaction chamber 37 is of fireclay, and is spaced from the outer casing 1 by firebrick 52. The interior of the chamber 37 is preferably maintained at a pressure slightly below atmospheric, so that no chlorine or arsenious chloride vapour pass outward through the joints. Any inward passage of air is also undesirable, and it is found that satisfactory results are obtained with a slight vacuum of $\frac{1}{200}$ in. of water.

190,032. Gums or Resins, Process for the Treatment of. L. Eynon and J. H. Lane, 7 and 8, Idol Lane, London, E.C.3. Application date, January 9, 1922.

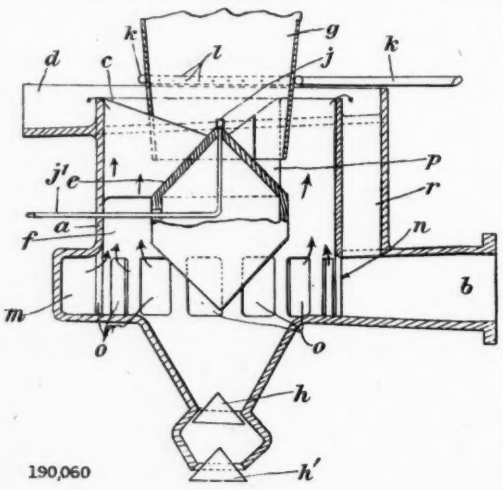
The process is for purifying gums, more particularly crude acaroid gum or resin, to free it from all woody and other insoluble impurities. The gum is treated with alkaline earths such as lime, strontia or baryta. A mixture of lime and water may be used, in the proportion of 4 parts of slaked lime and 100 parts of water to 10 parts of the finely ground crude gum. This treatment may be carried out in a rotatable vessel or a vessel having a stirring device. After the greater part of the gum has dissolved, the mixture is allowed to stand, and the gum solution decanted. The undissolved gum is treated with a fresh charge of gum and lime. The solution is then treated with the minimum quantity of cold hydrochloric acid to precipitate the whole of the gum, and the mixture is then heated to boiling point to coagulate the precipitated gum. The resulting aceroid gum is much lighter in colour than the original gum, and is soluble in alcohol, yielding a clear orange-red solution. This decolourisation of the gum is not obtained by the use of alkalis such as caustic soda, in which the colouring matter is soluble, and the use of lime ensures that no excess of alkali is present in the solution and thus reduces the quantity of hydrochloric acid required.

190,051. Vulcanisation of Rubber. The Peachey Process Co., Ltd., 83, Pall Mall, London, and S. J. Peachey, 44, Platts Lane, Hampstead, London. Application date, January 28, 1922.

The process is for accelerating the vulcanisation of rubber solution by means of the interaction of hydrogen sulphide and sulphur dioxide gases in the rubber solution. It is found that the vulcanisation may be greatly accelerated by the addition of a small quantity of quinone to the rubber solution. In an example, 50 cc. of a 12·5 per cent. solution of masticated rubber in benzol are saturated with hydrogen sulphide, and mixed with 5 cc. of a 2·4 per cent. solution of sulphur dioxide in benzol; 5 cc. of benzol containing 0·0625 gram of quinone are then added. The mixture is vulcanised in 12 minutes as compared with 30 minutes without the addition of quinone; if the quantity of quinone is doubled the vulcanisation is effected in 7 minutes.

190,060. Separation of Minerals, Apparatus for. T. C. Futers, 5, Collingwood Street, Newcastle-on-Tyne. Application date, February 14, 1922.

The apparatus is for the separation of minerals in a stream of water by means of their different specific gravities, and



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means are provided for supplying air or oil or an oily mixture to the mineral to facilitate the separation. Water is admitted through the inlet *b* to a circular vessel *a*, and the water passes inwards from an annular channel *m* through openings *o* in a circular wall *n*. The water overflows over the upper rim *c* into a launder *d*. The mineral is supplied through a hopper *g*, and is deflected by means of a cone *e* into the annular space *f*. The lighter particles are carried upward by the water into the launder *d*, and heavier particles pass downwards to the discharge valve *h*, h^1. Air or oil is supplied through a pipe j^1 to a nozzle *j* at the apex of the cone *e* below the water level, and air or oil may also be supplied through a perforated pipe *k* at the water level in the hopper *g*.

NOTE.—Abstracts of the following specifications, which are now accepted, appeared in THE CHEMICAL AGE when they became open to inspection under the International Convention: 164,731 (E. Liebreich), relating to a process for separating metallic chromium, see Vol. V., p. 193; 168,902 (Norsk Hydro-Elektrisk, Kvaelstofaktieselskab) relating to the production of ammonia from nitrogen and hydrogen, see Vol. V., p. 603; 169,996 (Koppers Co.), relating to an apparatus and process for purifying gases, see Vol. V., p. 710; 181,385 (B. H. Jacobson), relating to a process for making anhydrous metallic chlorides, see Vol. VII., p. 249; 184,184 (Consortium für Elektro-Chemische Industrie Ges.), relating to a process for purifying acetylene, see Vol. VII., p. 538.

International Specification not yet Accepted

188,344. STARCH. A. Singer, 39, Damjanich-Ucta, Budapest. International Convention date, November 5, 1921.

Starch or material containing it, such as potato flour, is ground with dry caustic alkali for several hours, and then treated with the stoichiometrical quantity of a stable organic acid, such as oxalic acid, to neutralise it. The resulting product swells to a transparent jelly when treated with cold water.

LATEST NOTIFICATIONS.

190,990. Pulverising apparatus. Powdered Fuel Plant Co., Ltd. December 31, 1921.
190,995. Process for the manufacture of sulphur proto-chloride. Legeler, Dr. E. December 29, 1921.
191,000. Process for rendering soluble liquid-fuel mixtures of petrol and alcohol. Allenet et Cie., R. December 28, 1921.
191,002. Manufacture of butyl chlorides. Allenet et Cie., R. December 28, 1921.
191,008. Manufacture of unsymmetrical dialkylbarbituric acids and new products therefrom. Layraud, E. December 31, 1921.
191,028. Manufacture of hydroxylated aliphatic arsenic acids. Etablissements Poulenc Frères, and Oechslin, C. December 29, 1921.
191,029. Manufacture of aliphatic arsenical compounds. Etablissements Poulenc Frères, and Oechslin, C. December 30, 1921.
191,037. Process for the treatment of hydrocarbons, particularly crude petroleum. Dederich, W. December 31, 1921.
191,064. Manufacture of 1-phenylimino-2-naphthoquinone. Soc. Anon. des Matières Colorantes et Produits Chimiques de Saint-Denis. Wahl, A., and Lantz, R. December 28, 1921.

Specifications Accepted, with Date of Application

173,735. Purifying saccharine juices or liquids, Process for. Soc Ricard, Allenet et Cie. January 6, 1921.
190,510. Rubber, Treatment of. C. Reid. July 20, 1921.
190,516. Pulverising or disintegrating machines. Sir E. P. C. Girouard and F. W. S. Jones. August 23, 1921.
190,545. Gas generators. F. Umpleby and H. Powers. September 24, 1921.
190,553. Petroleum and other liquid hydrocarbons, Treatment of. A. E. Dunstan and F. G. P. Remfry. September 28, 1921.
190,688. Anhydrous metal chlorides, Manufacture of. B. H. Jacobson. May 31, 1922. Addition to 181,385.

Applications for Patents

Astier de la Vigerie, H. d'. and Girault, E. Manufacture and utilisation of bio-catalytic sludges and purifying yeasts. 65. January 1.
Bader, W., and British Cellulose and Chemical Mfg. Co., Ltd. Treatment of cellulose-acetate products. 42. 43. January 1.
Boehm, W. Manufacture of alumina. 251. January 3. (Germany, ——).
Box, E. Destructive distillation of refuse, brown coal, etc., and recovery of products therefrom. 428. January 5.
Cadwell, S. M. Processes for vulcanising rubber. 169. January 2. (United States, March 25, 1921.)
Clapp, H. B. Facilitating catalytic, etc., reactions. 151. January 2.
Dreaper, W. P. Manufacture of solutions of cellulose, cellulose esters, or cellulose compounds. 55. January 1.
Dunstan, A. E., and Smith, T. A. Treatment of mineral oils. 479. January 5.
Heyl, G. E. Distillation of shale coal, etc., for formation of road materials, briquettes, etc. 305. January 4.
Hofsäss, M., and Internationale Bergin Compagnie voor Olie en Kolen-Chemie. Process of treating heavy mineral oils, coal distillates, etc. 175. January 2.
Lanhoffer, I. E., and O. E. Manufacture of asbestos-cement compositions. 139. January 2. (France, June 13, 1922).
Metals Production, Ltd., and Taplin, T. J. Leaching copper ores containing slimes. 78. January 1.
Nicholson, W. E. Manufacture of sulphuric acid. 478. January 5.
Serebriany, M. Manufacture of products from disintegrated organic material. 254. January 3.
Wilkinson, E. C. Treatment of exhaust gases of internal-combustion engines. 429. January 5.

Finance and Industrial Research

Importance of the Co-ordinating Element

IN an article in the *Manchester Guardian* dealing with the relation of finance to industrial research, Mr. Norman Swindin says that no organisation in this country before the war would have undertaken such a lengthy and expensive research as that which was undertaken in the development of the Haber-Bosch synthetic ammonia process, and even if it had had the will, it could not have sustained public interest for ten years whilst three or four millions were being poured out in the erection of plant, most of which was destined for the scrap-heap.

Mr. Swindin points out that the chief factors in successful organised research are knowledge, experience, finance, and co-ordination, and expresses the opinion that the general ignorance of the true meaning and of the cost of research has always hindered the development of straightforward methods of finance. As examples of the state of totally unorganised research which has prevailed in the past he cites the cyaniding of gold ores, the manufacture of soda by the ammonia process, of caustic-soda and of chlorine by electrolysis, the early synthetic dye processes, and the low-temperature carbonisation of coal.

As a result of having been engaged on five first-class chemical processes the final development of which was greatly hindered by bad, insincere, and foolish finance, Mr. Swindin has come to the conclusion that the financial side needs controlling by a co-ordinating and adjusting element, which at present is not easily obtained. When things go wrong with the research or when research is found to be a long, toilsome journey into the unknown the financier is at the mercy of technical experts. Someone is appointed with a reputation of having brought to success similar industrial work. He cannot, from the fact that original research is in question, know enough to form an opinion which will be an adequate basis for impartial report, but nevertheless the report is issued, and if it is condemnatory the financier stops the research and the work of years is wasted. It was in this way, he concludes, that a fascinating and promising process for the manufacture of sodium cyanide by electrolysis of soda ash and ammonia was turned down by an expert who failed to grasp the significance of the first reaction.

Synthetic Apple Oil Discovery

As a result of recent investigations Messrs. F. B. Power and V. K. Chesnut, of the Bureau of Chemistry, United States Department of Agriculture, have found that the odorous constituents of the apple include in addition to the combination of the amyl esters of formic, acetic, caproic, and caprylic acids, together with acetaldehyde, also a very small amount of the aliphatic terpene alcohol, geraniol, $C_{10}H_{18}O$. This substance may be considered to exist both in the free state and in the form of its esters, and it imparts to the apple a distinctive fragrance. Although contained in very small proportion in the most fragrant varieties of the fruit, it is believed to be a constituent of all apples. Geraniol or its esters has been found to modify to a considerable degree the odour of their synthetic apple oil and to enhance materially its fragrance, thus enabling them to reproduce more truly and completely the natural odour of the choicest apples.

Market Report and Current Prices

Our Market Report and Current Prices are exclusive to THE CHEMICAL AGE, *and, being independently prepared with absolute impartiality by Messrs. R. W. Greeff & Co., Ltd., and Messrs. Chas. Page & Co., Ltd., may be accepted as authoritative. The prices given apply to fair quantities delivered ex wharf or works, except where otherwise stated. The current prices are given mainly as a guide to works managers, chemists, and chemical engineers; those interested in close variations in prices should study the market report.*

LONDON, JANUARY 11, 1923.

TRADE has been inclined to be rather quieter during the current week, probably owing to the uncertain outlook on the Continent. On the other hand, markets continue very healthy with a firm undertone, and it is expected that business will again broaden within the next week or two.

Export demand is maintained, especially for Far Eastern markets, and some considerable business has been placed.

General Chemicals

ACETONE is in slightly better supply, but price remains very firm.

ACID ACETIC has registered a further slight advance, and stocks are light.

ACID CITRIC is in slightly better demand, and price is without change.

ACID FORMIC is in fair request, and the easier price noted last week is unchanged.

ACID LACTIC is in fair demand without change in value.

ACID OXALIC is in moderate request, and the price is firm.

ACID TARTARIC is in slightly better demand.

ARSENIC continues strong in all positions, and price is inclined to be higher.

BARIUM CHLORIDE is very quiet, and the price is easy.

CREAM OF TARTAR.—A better business is reported, and an early advance in value is expected.

COPPER SULPHATE continues quiet, although business is somewhat better than it has been of late.

FORMALDEHYDE is again higher, and supplies on the light side.

LEAD ACETATE.—Price maintained, and demand fair.

LEAD NITRATE is unchanged.

METHYL ALCOHOL is in active demand, but supplies are difficult to obtain.

POTASSIUM CARBONATE is inclined to be firmer and in better request.

POTASSIUM CAUSTIC has also moved in sympathy with carbonate, although the demand still leaves a great deal to be desired.

POTASSIUM PERMANGANATE.—The higher price is maintained, and a good business is passing.

POTASSIUM PRUSSIATE continues very scarce and firm.

SODIUM ACETATE.—Price maintained, and in moderate request.

SODIUM HYPOSULPHITE is in active demand, and some good business for export has been placed.

SODIUM NITRITE.—Without change in value, and in moderate demand.

SODIUM PRUSSIATE continues firm, but is only in moderate request at the moment.

Pharmaceutical Chemicals

ACETYL SALICYLIC ACID.—A higher price has been paid for best brands.

ACID SALICYLIC B.P.—Has advanced in sympathy with the carbolic acid market.

COCAINE.—The cheaper parcels having passed into consumption, manufacturers' agents are now asking higher prices, which have been paid.

COCA LEAVES are firm, and cocaine may consequently be expected to advance still further in the near future.

CORROSIVE SUBLIMATE is slightly easier in sympathy with mercury.

HEXAMINE.—Supplies are none too plentiful on a rising market.

MILK SUGAR.—When present stocks are liquidated higher prices may be expected, based on the advance quotations made by makers.

PARALDEHYDE is steady and continues in good demand.

PHENACETIN cannot be replaced at current price, and should improve.

SALOL is firmly held for higher prices.

SODA SALICYLATE.—We believe the lowest level has been reached and anticipate a better market.

SODA BENZOATE is very firm and higher prices may be expected.

VANILLIN continues weak, orders being keenly competed for.

Coal Tar Intermediates

Business during the past week has continued to be rather more interesting, although no great volume is passing.

ALPHA NAPHTHOL continues in short supply and the price is firm.

ALPHA NAPHTHYLAMINE has been of moderate interest at the reduced price.

ANILINE OIL is easy.

ANILINE SALT—Some small orders have been received.

BENZIDINE BASE continues in demand on home account.

BETA NAPHTHOL.—Some fair inquiries have been received, but buyers are a little inclined to hold off.

BETA NAPHTHYLAMINE is without special feature.

DIMETHYLANILINE is steady and some home orders have been received.

DIPHENYLAMINE is very firm with no excessive stocks available.

H. ACID has been inquired for.

PARANITRANILINE.—Following recent reductions some fair business has been received.

PARAPHENYLENEDIAMINE is firm and in good demand.

Coal Tar Products

There is little change in the position of the market from last week. The general firm tone is well maintained and prices for most products show an upward tendency.

90% BENZOL is in poor demand and can be bought at 1s. 7d. to 1s. 8d. per gallon on rails in the North, and 1s. 11d. to 2s. per gallon in London.

PURE BENZOL is also fairly plentiful and is quoted at from 2s. to 2s. 2d. per gallon on rails in the North and from 2s. 4d. to 2s. 6d. per gallon in London.

CREOSOTE OIL is scarce for near position and is worth about 7¼d. per gallon in the North and 7¾d. to 8d. per gallon in London.

CRESYLIC ACID is in no great demand and the dark quality, 95-97 per cent., is quoted at about 1s. 9d. per gallon on rails, while the pale, 97-99 per cent., is offered at 1s. 11d. to 2s. per gallon.

SOLVENT NAPHTHA is interesting at about 1s. 7d. per gallon on rails in the North, while in London the price is quoted at from 1s. 10d. to 2s. per gallon.

HEAVY NAPHTHA is quiet and is worth about 1s. 6d. per gallon on rails.

PITCH.—The market remains firm and prices still have an upward tendency, but buyers hesitate to place further orders, as they find the manufacture of patent fuel, based on the present price of pitch, to be unprofitable. To-day's quotations are: London, 137s. 6d. to 140s.; East Coast, 135s. to 137s. 6d.; West Coast, 135s.

Sulphate of Ammonia

Buyers in the home market, as well as abroad, are beginning to show more interest in spring deliveries. Prices are unchanged.

Current Prices

General Chemicals

	Per	£	s.	d.		£	s.	d.
Acetic anhydride	lb.	0	1	5	to	0	1	7
Acetone oil	ton	80	0	0	to	82	10	0
Acetone, pure	ton	130	0	0	to	135	0	0
Acid, Acetic, glacial, 99-100%	ton	67	0	0	to	68	0	0
Acetic, 80% pure	ton	45	0	0	to	46	0	0
Arsenic, liquid, 2000 s.g.	ton	67	0	0	to	70	0	0
Boric, cryst.	ton	55	0	0	to	60	0	0
Carbolic, cryst. 39-40%	lb.	0	0	7	to	0	0	7½
Citric	lb.	0	1	9	to	0	1	10
Formic, 80%	ton	51	0	0	to	53	0	0
Hydrofluoric	lb.	0	0	7½	to	0	0	8½
Lactic, 50 vol.	ton	41	0	0	to	43	0	0
Lactic, 60 vol.	ton	43	0	0	to	44	0	0
Nitric, 80 Tw.	ton	27	0	0	to	29	0	0

	Per	£	s.	d.		£	s.	d.
Acid, **Oxalic**	lb.	0	0	7½	to	0	0	7½
Phosphoric, 1.5	ton	40	0	0	to	42	0	0
Pyrogallic, cryst.	lb.	0	5	9	to	0	6	0
Salicylic, Technical	lb.	0	1	1	to	0	1	3
Sulphuric, 92–93%	ton	6	10	0	to	7	10	0
Tannic, commercial	lb.	0	2	3	to	0	2	9
Tartaric	lb.	0	1	2½	to	0	1	3
Alum, lump	ton	13	0	0	to	13	10	0
Alum, chrome	ton	28	0	0	to	29	0	0
Alumino ferric	ton	9	0	0	to	9	5	0
Aluminium, sulphate, 14–15%	ton	10	10	0	to	11	0	0
Aluminium, sulphate, 17–18%	ton	11	10	0	to	12	0	0
Ammonia, anhydrous	lb.	0	1	6	to	0	1	8
Ammonia, .880	ton	33	0	0	to	35	0	0
Ammonia, .920	ton	21	0	0	to	23	0	0
Ammonia, carbonate	lb.	0	0	4	to	0	0	4½
Ammonia, chloride	ton	50	0	0	to	55	0	0
Ammonia, muriate (galvanisers)	ton	35	0	0	to	37	10	0
Ammonia, nitrate (pure)	ton	35	0	0	to	40	0	0
Ammonia, phosphate	ton	65	0	0	to	68	0	0
Ammonia, sulphocyanide	lb.	0	1	10	to	0	2	0
Amyl acetate	ton	175	0	0	to	185	0	0
Arsenic, white, powdered	ton	70	0	0	to	75	0	0
Barium, carbonate, 92–94%	ton	55	0	0	to	66	0	0
Barium, Chlorate	ton	65	0	0	to	70	0	0
Barium Chloride	ton	18	0	0	to	19	0	0
Nitrate	ton	31	0	0	to	33	0	0
Sulphate, blanc fixe, dry	ton	20	10	0	to	21	0	0
Sulphate, blanc fixe, pulp	ton	10	5	0	to	10	10	0
Sulphocyanide, 95%	lb.	0	1	0	to	0	1	3
Bleaching powder, 35–37%	ton	11	0	0	to		—	
Borax crystals	ton	28	0	0	to	32	0	0
Calcium acetate, Brown	ton	12	10	0	to	13	10	0
,, ,, Grey	ton	17	10	0	to	18	0	0
Calcium Carbide	ton	16	0	0	to	17	0	0
Chloride	ton	6	0	0	to	7	0	0
Carbon bisulphide	ton	50	0	0	to	52	0	0
Casein technical	ton	98	0	0	to	105	0	0
Cerium oxalate	lb.	0	3	0	to	0	3	6
Chromium acetate	lb.	0	1	1	to	0	1	3
Cobalt acetate	lb.	0	6	0	to	0	6	6
Oxide, black	lb	0	9	6	to	0	10	0
Copper chloride	lb.	0	1	2	to	0	1	3
Sulphate	ton	27	10	0	to	28	10	0
Cream Tartar, 98–100%	ton	100	0	0	to	102	0	0
Epsom salts (*see* Magnesium sulphate)								
Formaldehyde, 40% vol.	ton	90	0	0	to	95	0	0
Formusol (Rongalite)	lb.	0	2	6	to	0	2	9
Glauber salts, commercial	ton	5	0	0	to	5	10	0
Glycerin, crude	ton	65	0	0	to	67	10	0
Hydrogen peroxide, 12 vols.	gal.	0	2	3	to	0	2	4
Iron perchloride	ton	30	0	0	to	32	0	0
Iron sulphate (Copperas)	ton	3	10	0	to	4	0	0
Lead acetate, white	ton	41	0	0	to	43	0	0
Carbonate (White Lead)	ton	42	0	0	to	47	0	0
Nitrate	ton	44	10	0	to	45	0	0
Litharge	ton	35	10	0	to	36	0	0
Lithopone, 30%	ton	22	10	0	to	23	10	0
Magnesium chloride	ton	5	10	0	to	6	0	0
Carbonate, light	cwt.	2	10	0	to	2	15	0
Sulphate (Epsom salts commercial)	ton	6	10	0	to	7	0	0
Sulphate (Druggists')	ton	10	0	0	to	11	0	0
Manganese Borate, commercial	ton	65	0	0	to	75	0	0
Sulphate	ton	60	0	0	to	62	0	0
Methyl acetone	ton	70	0	0	to	75	0	0
Alcohol, 1% acetone	ton	105	0	0	to	110	0	0
Nickel sulphate, single salt	ton	49	0	0	to	51	0	0
Ammonium sulphate, double salt	ton	51	0	0	to	52	0	0
Potash, Caustic	ton	32	0	0	to	33	0	0
Potassium bichromate	lb.	0	0	6	to	0	0	6½
Carbonate, 90%	ton	31	0	0	to	33	0	0
Chloride, 80%	ton	12	0	0	to	12	10	0
Chlorate	lb.	0	0	4½	to	0	0	5
Metabisulphite, 50–52%	ton	84	0	0	to	90	0	0
Nitrate, refined	ton	43	0	0	to	45	0	0
Permanganate	lb.	0	0	9	to	0	0	9½
Prussiate, red	lb.	0	4	3	to	0	4	6
Prussiate, yellow	lb	0	1	6½	to	0	1	7½
Sulphate, 90%	ton	13	0	0	to	13	10	0
Salammoniac, firsts	cwt.	3	3	0	to		—	
Seconds	cwt.	3	0	0	to		—	
Sodium acetate	ton	24	10	0	to	24	15	0
Arseniate, 45%	ton	45	0	0	to	48	0	0
Bicarbonate	ton	10	10	0	to	11	0	0
Bichromate	lb.	0	0	4½	to	0	0	4¾
Bisulphite 60–62%	ton	21	0	0	to	23	0	0
Chlorate	lb.	0	0	3¾	to	0	0	4

	Per	£	s.	d.		£	s.	d.
Sodium **Caustic, 70%**	ton	19	10	0	to	20	0	0
Caustic, 76%	ton	20	10	0	to	21	0	0
Hydrosulphite, powder, 85%	lb.	0	1	7	to	0	1	9
Hyposulphite, commercial	ton	10	10	0	to	11	0	0
Nitrite, 96–98%	ton	29	10	0	to	30	0	0
Phosphate, crystal	ton	16	0	0	to	16	10	0
Perborate	lb.	0	0	11	to	0	1	0
Prussiate	lb.	0	0	10½	to	0	0	11
Sulphide, crystals	ton	10	10	0	to	11	0	0
Sulphide, solid, 60–62%	ton	16	10	0	to	17	10	0
Sulphite, cryst.	ton	12	10	0	to	13	0	0
Strontium carbonate	ton	55	0	0	to	60	0	0
Strontium Nitrate	ton	40	0	0	to	42	0	0
Strontium Sulphate, white	ton	6	10	0	to	7	10	0
Sulphur chloride	ton	25	0	0	to	27	10	0
Sulphur, Flowers	ton	11	0	0	to	12	0	0
Roll	ton	11	0	0	to	12	0	0
Tartar emetic	lb.	0	1	3	to	0	1	4
Theobromine	lb.	0	12	6	to	0	13	0
Tin perchloride, 33%	lb.	0	1	2	to	0	1	4
Perchloride, solid	lb.	0	1	5	to	0	1	7
Protochloride (tin crystals)	lb.	0	1	5	to	0	1	6
Zinc chloride 102° Tw.	ton	21	0	0	to	22	10	0
Chloride, solid, 96–98%	ton	25	0	0	to	30	0	0
Oxide, 99%	ton	37	0	0	to	38	0	0
Dust, 90%	ton	45	0	0	to	47	10	0
Sulphate	ton	16	10	0	to	17	10	0

Pharmaceutical Chemicals

Acetyl salicylic acid	lb.	0	2	10	to	0	3	0
Acetanilid	lb.	0	1	4	to	0	1	6
Acid, Gallic, pure	lb.	0	3	0	to	0	3	3
Lactic, 1.21	lb.	0	2	9	to	0	3	0
Salicylic, B.P.	lb.	0	1	5	to	0	1	7
Tannic, leviss	lb.	0	3	4	to	0	3	6
Amidol	lb.	0	8	6	to	0	8	9
Amidopyrin	lb.	0	14	6	to	0	15	0
Ammon ichthosulphonate	lb.	0	2	0	to	0	2	3
Barbitone	lb.	0	12	6	to	0	13	6
Beta naphthol resublimed	lb.	0	1	9	to	0	2	0
Bromide of ammonia	lb.	0	0	8½	to	0	0	9
Potash	lb.	0	0	7½	to	0	0	8
Soda	lb.	0	0	8	to	0	0	8½
Caffeine, pure	lb.	0	12	0	to	0	12	3
Calcium glycerophosphate	lb.	0	5	6	to	0	6	0
Calcium lactate	lb.	0	2	0	to	0	2	3
Calomel	lb.	0	4	9	to	0	5	0
Chloral hydrate	lb.	0	4	3	to	0	4	6
Cocaine alkaloid	oz.	0	18	6	to	0	19	0
Cocain hydrochloride	oz.	0	15	0	to	0	15	6
Corrosive sublimate	lb.	0	4	6	to	0	4	9
Eucalyptus oil, B.P. (70–75% eucalyptol)	lb.	0	1	7	to	0	1	7½
B.P. (75–80% eucalyptol)	lb.	0	1	8	to	0	1	8½
Guaiacol carbonate	lb.	0	8	0	to	0	8	3
Liquid	lb.	0	9	0	to	0	9	6
Pure crystals	lb.	0	10	0	to	0	10	6
Hexamine	lb.	0	3	3	to	0	3	6
Hydroquinone	lb.	0	3	3	to	0	3	6
Lanoline anhydrous	lb.	0	0	7½	to	0	0	8
Lecithin ex ovo	lb.	0	18	6	to	1	0	0
Lithia carbonate	lb.	0	9	9	to	0	10	3
Methyl salicylate	lb.	0	2	0	to	0	2	3
Metol	b.	0	10	0	to	0	10	6
Milk sugar	cwt.	4	17	6	to	5	2	6
Paraldehyde	lb.	0	1	4	to	0	1	6
Phenacetin	lb.	0	4	10	to	0	5	0
Phenazone	lb.	0	6	9	to	0	7	0
Phenolphthalein	lb.	0	5	0	to	0	5	3
Potassium sulpho guaiacolate	lb.	0	5	0	to	0	5	3
Quinine sulphate, B.P.	oz.	0	2	3			—	
Resorcine, medicinal	lb.	0	5	6	to	0	5	9
Salicylate of soda powder	lb.	0	1	10	to	0	2	0
Crystals	lb.	0	2	0	to	0	2	3
Salol	lb.	0	2	3	to	0	2	6
Soda Benzoate	lb.	0	2	0	to	0	2	3
Sulphonal	lb.	0	13	6	to	0	14	0
Terpene hydrate	lb.	0	1	9	to	0	2	0
Theobromine, pure	lb.	0	12	0	to	0	12	6
,, soda salicylate	lb.	0	8	6	to	0	9	0
Vanillin	lb.	1	3	6	to	1	4	6

Coal Tar Intermediates, &c.

Alphanaphthol, crude	lb.	0	2	0	to	0	2	3
Alphanaphthol, refined	lb.	0	2	6	to	0	2	9
Alphanaphthylamine	lb.	0	1	7	to	0	1	8
Aniline oil, drums extra	lb.	0	0	10	to	0	0	11
Aniline salts	lb.	0	0	10	to	0	0	11

	Per	£	s.	d.		£	s.	d.
Anthracene, 40–50%	unit	0	0	8½	to	0	0	9
Benzaldehyde (free of chlorine)	lb.	0	3	3	to	0	3	6
Benzidine, base	lb.	0	5	0	to	0	5	3
Benzidine, sulphate	lb.	0	4	3	to	0	4	6
Benzoic acid	lb.	0	2	0	to	0	2	3
Benzyl chloride, technical	lb.	0	2	0	to	0	2	3
Betanaphthol	lb.	0	1	4	to	0	1	4½
Betanaphthylamine, technical	lb.	0	4	6	to	0	5	0
Croceine Acid, 100% basis	lb.	0	3	3	to	0	3	6
Dichlorbenzol	lb.	0	0	9	to	0	0	10
Diethylaniline	lb.	0	4	3	to	0	4	6
Dinitrobenzol	lb.	0	1	1	to	0	1	2
Dinitrochlorbenzol	lb.	0	0	11	to	0	1	0
Dinitronaphthalene	lb.	0	1	4	to	0	1	5
Dinitrotoluol	lb.	0	1	4	to	0	1	5
Dinitrophenol	lb.	0	1	7	to	0	1	9
Dimethylaniline	lb.	0	2	6	to	0	2	9
Diphenylamine	lb.	0	4	0	to	0	4	3
H-Acid	lb.	0	5	3	to	0	5	6
Metaphenylenediamine	lb.	0	4	6	to	0	4	9
Monochlorbenzol	lb.	0	0	10	to	0	1	0
Metanilic Acid	lb.	0	5	9	to	0	6	0
Metatoluylenediamine	lb.	0	4	6	to	0	4	9
Monosulphonic Acid (2.7)	lb.	0	5	6	to	0	6	0
Naphthionic acid, crude	lb.	0	2	3	to	0	2	6
Naphthionate of Soda	lb.	0	2	6	to	0	2	9
Naphthylamin-di-sulphonic-acid	lb	0	4	0	to	0	4	3
Neville Winther Acid	lb.	0	7	9	to	0	8	0
Nitrobenzol	lb.	0	0	8½	to	0	0	9
Nitronaphthalene	lb.	0	1	2	to	0	1	3
Nitrotoluol	lb.	0	1	0	to	0	1	1
Orthoamidophenol, base	lb.	0	12	0	to	0	12	6
Orthodichlorbenzol	lb.	0	1	0	to	0	1	1
Orthotoluidine	lb.	0	1	0	to	0	1	3
Orthonitrotoluol	lb.	0	0	6	to	0	0	8
Para-amidophenol, base	lb.	0	8	6	to	0	9	0
Para-amidophenol, hydrochlor	lb.	0	7	6	to	0	8	0
Paradichlorbenzol	lb.	0	0	6	to	0	0	7
Paranitraniline	lb.	0	3	0	to	0	3	3
Paranitrophenol	lb.	0	2	3	to	0	2	6
Paranitrotoluol	lb.	0	5	0	to	0	5	3
Paraphenylenediamine, distilled	lb.	0	11	6	to	0	11	9
Paratoluidine	lb.	0	5	9	to	0	6	3
Phthalic anhydride	lb.	0	2	6	to	0	2	9
Resorcin, technical	lb.	0	4	6	to	0	5	0
Sulphanilic acid, crude	lb.	0	1	11	to	0	1	0
Tolidine, base	lb.	0	7	0	to	0	7	6
Tolidine, mixture	lb.	0	2	6	to	0	2	9

Essential Oils and Synthetics

(Prices supplied by Essences and Synthetics, Ltd.)

		£	s.	d.
Essential Oils				
Aniseed Star and Redship	c.i.f. price 1/11¼	0	2	2
Bergamot	14/0 to	0	14	6
Bois de Rose female		0	10	6
Camphor white	per cwt.	4	5	6
Cassia 80–85%		0	8	9
Cedarwood		0	1	6
Cinnamon Ceylon leaf	per oz.	0	0	4½
Citronella Ceylon		0	2	5
Clove oil		0	6	0
Dill		0	13	0
Geranium Bourbon		1	6	0
Gingergrass		0	9	0
Lemon		0	3	0
Lime West Indian Distilled		0	2	0
Mandarin		0	16	0
Mint dementholised Kobayashi's or Suzuki's		0	8	6
Orange Sicilian		0	9	6
Parma rosa		0	16	0
Patchouli		1	17	6
Peppermint American		0	13	6
Petitgrain Paraguay		0	7	0
Sassafras		0	5	0
Spearmint		0	14	0
Synthetics				
Benzyl acetate		0	2	9
Benzyl benzoate		0	2	9
Linalol		0	19	6
Linalyl acetate		1	4	6
Terpeniol		0	3	0
Coumarine		0	11	0
Heliotropine		0	5	6
Ionone 100%		1	7	0
Geraniol Java		0	6	6
Geraniol Parma rosa		1	10	0
Rhodinol extra		2	10	0
Methyl salicylate		0	2	0
Citral		0	10	0
Musk xylol		0	10	6

The Manchester Chemical Market

(From Our Own Correspondent.)

Manchester, January 11, 1923.

Business on the chemical market here during the past week has only been on quiet lines, without as yet much indication of the fillip that has been expected. Buying for home consumption is fairly steady, but usually parcels are small, while the foreign trade section is in much the same position as during the last few weeks, Continental business being distinctly dull, and the Dominions taking the lion's share of the shipments. Prices all round are keeping firm, slight cuts here and there being counterbalanced by additional firmness in other lines.

Heavy Chemicals

Caustic soda continues to meet with a rather good demand from home buyers and also for shipment, quotations ranging from £19 per ton for 60–68 per cent. strength to £21 10s. for 76–77 per cent. Bleaching powder is likewise a healthy feature of the market at from £10 10s. to £11 10s. per ton. Glauber salts are quiet, but the price is maintained at £4 10s. per ton. Soda crystals are also firm at £5 10s. per ton delivered, but the demand is again rather inactive. Saltcake is unchanged either in position or value, and £4 10s. per ton is still quoted. Buyers are paying little attention to sodium sulphide, which is easier at about £16 per ton for 60–65 per cent. concentrated. Bicarbonate of soda is steady and in fair demand at £10 10s. per ton, in 2-cwt. bags. Alkali is in good inquiry both for home and export, and prices are firm at £7 12s. 6d. to £7 15s. per ton for 58 per cent. material. Hyposulphite of soda meets with a very subdued demand, though prices are maintained at £16 per ton for photographic crystals, and £10 for commercial. Nitrite of soda keeps steady at £27 per ton. Phosphate of soda is quoted at £16 per ton, but little business is passing. Chlorate of soda is quite firm at 3d. per lb., a fair trade being done. Prussiate of soda is rather scarce and firm at 10d. to 10½d. per lb. Bichromate of soda is quiet again at 4½d. per lb. Acetate of soda is firmer, and is now quoted at about £24 per ton.

Caustic potash is still on the quiet side, though prices are fully maintained at last week's level of £28 to £28 10s. per ton for 88–90 per cent. strength. Bichromate of potash also meets with only a moderate inquiry at 6d. per lb. Supplies of prussiate of potash are still short, and sellers are firm at 1s. 6d. per lb. for yellow, with red unchanged at 4s. Carbonate of potash is selling fairly satisfactorily, and quotations are a shade higher again at £31 per ton for 96–98 per cent. material. Chlorate of potash is steady at 3½d. to 3¾d. per lb., a rather good inquiry being met with. Permanganate of potash is very firm at 8d. per lb., sellers reporting a slight improvement.

Sulphate of copper is said to be looking up again on export account at about £26 10s. per ton; the home trade section is, however, still quiet, The export demand for arsenic continues, and between £70 and £75 per ton is being asked for available lots of white powdered, Cornish makes. Commercial Epsom salts are in better inquiry at £6 per ton, with Continental supplies at lower figures; magnesium sulphate, B.P., is quoted at about £8. Grey acetate of lime is rather scarce, and prices are firm at £16, brown being unchanged at £8 per ton. Nitrate of lead is still quiet at £42 per ton. White sugar of lead is also in short supply, and about £39 per ton is now asked, with brown firmer at £36. Ammonium muriate, grey, is steady at £31 10s. per ton. Phosphate of ammonia is improving, and supplies are now offered at £65 per ton. Alum is dull at about £12 per ton for loose lump.

Acids and Tar Products

Tartaric acid is firm at 1s. 2d. per lb., but little business is being done. Citric acid is also steady at 1s. 8d. per lb. for B.P. crystals, a slightly better demand being reported. Acetic acid is again firmer, £68 now being asked for glacial and £43 per ton for 80 per cent. technical, the overseas demand keeping up. Oxalic acid is quiet but steady at 7d. per lb.

The demand for pitch for export is very persistent, and £6 to £6 5s. per ton f.o.b. Manchester, is wanted for prompt shipment. Carbolic acid crystals are firm and in good demand at 8½d. per lb., with crude, 60 per cent., selling at about 2s. 6d. per gallon. Benzole is quiet and unchanged at 1s. 8d. per gallon. Solvent naphtha is quoted at 1s. 9d. to 1s. 10d. per gallon, but not a great deal is being disposed of. Creosote oil is steady and in good demand for export at 7¼d. per gallon. Naphthalenes are now quoted at up to £8 per ton for crude, £17 for flake, and £16 per ton for crystals.

Scottish Chemical Market

The following notes on the Scottish Chemical Market are specially supplied to THE CHEMICAL AGE *by Messrs. Charles Tennant and Co., Ltd., Glasgow, and may be accepted as representing the firm's independent and impartial opinions.*

GLASGOW, JANUARY 10, 1923.

ON resuming after the holidays business has been fairly satisfactory, inquiries being numerous, with a good proportion of orders booked.

Several articles show an upward tendency in price, notably red lead, formaldehyde and acetic acid.

Industrial Chemicals

ACETONE.—Demand is less active but price remains firm around £120 per ton.

ACID ACETIC.—Glacial 98/100% quoted £58 to £64 per ton; 80% technical, £42 to £44 per ton; 80% pure, £44 to £46 per ton, ex wharf.

ACID BORACIC.—Price unchanged. Crystal or granulated, £55 per ton; powdered, £57 per ton, carriage paid U.K.

ACID CITRIC.—Quoted 1s. 7d. per lb. spot delivery.

ACID FORMIC, 85%.—Inclined to be higher at £54 to £55 per ton.

ACID HYDROCHLORIC.—No change in price; 6s. 6d. per carboy, ex works.

ACID NITRIC, 84°.—Little inquiry. About £27 per ton, ex station, full loads.

ACID OXALIC.—Quoted 7⅛d. per lb., ex store.

ACID SULPHURIC.—144°, £4 per ton; 168°, £7 5s. per ton, ex works, full loads; de-arsenicated quality, £1 per ton more.

ACID TARTARIC.—Moderate inquiry, 1s. 2d. per lb., ex store.

ALUM, CHROME.—Quoted £26 per ton, f.o.b. U.K.

ALUM, LUMP POTASH.—In little demand. Price about £12 10s. per ton, ex store.

ALUMINA, SULPHATE.—Slight export inquiry, £10 10s. per ton, f.o.b. for 17/18%.

AMMONIA ANHYDROUS.—Quoted 1s. 6d. per lb., ex station.

AMMONIA CARBONATE.—Lump, 4d. per lb.; ground, 4¼d. per lb., delivered.

AMMONIA LIQUID.—880°, 3½d. per lb.; 920°, 1⅜d. per lb. ex works.

AMMONIA MURIATE.—Grey galvanisers quality, £31 to £32 per ton, ex works.

AMMONIA SULPHATE.—25¼ per cent., £16 8s. per ton; 25¾%, £15 5s. per ton, ex works, Jan.—Feb.

ARSENIC, WHITE POWDERED.—Supplies very hard to obtain. Quoted, £65 to £70 per ton, f.o.r.

BARIUM CHLORIDE, 98/100%.—Offered from the Continent at £17 5s. per ton, c.i.f. U.K.

BARYTES.—English makers' price unchanged at £5 5s. per ton, ex works for finest white.

BLEACHING POWDER.—Spot lots, £11 10s. per ton, ex station. Moderate export inquiry.

BORAX.—Price unchanged; crystal or granulated £28 per ton; powdered, £29 per ton, carriage paid U.K. stations.

CALCIUM CHLORIDE.—English make, £5 15s. per ton, ex quay or station. Continental material, £4 per ton, c.i.f. U.K.

COPPER SULPHATE.—Moderate inquiry for export. Price about £26 per ton, f.o.b. U.K.

COPPERAS, GREEN.—Offered at £3 15s. per ton, ex works.

FORMALDEHYDE, 40%.—Good inquiry. Now quoted £91 to £92 per ton, ex wharf.

GLAUBER SALTS.—In little demand. Price £3 15s. to £4 per ton, ex store.

LEAD.—Red advanced by English makers by £1 per ton to £39 15s.; white advanced 15s. to £51 10s. per ton, delivered U.K. 5 ton lots. Continental red lead now £34 to £36 per ton, ex store.

LEAD NITRATE.—Quoted £41 per ton, ex store.

MAGNESITE, GROUND CALCINED.—In little demand. Quoted £7 to £10 per ton, ex store.

MAGNESIUM CHLORIDE.—Spot material about £4 10s. per ton, ex store. Offered from Continent at £3 per ton, c.i.f. U.K.

MAGNESIUM SULPHATE (EPSOM SALTS).—Commercial quality, £7 per ton; B.P. quality, £8 15s. per ton, f.o.r. in ton lots.

POTASSIUM BICHROMATE.—English maker's price, 6d. per lb., delivered.

POTASSIUM CARBONATE, 88/92%.—In little demand. Spot material, £27 per ton.

POTASSIUM CAUSTIC, 88/92%.—Moderate inquiry, £29 per ton, ex store spot delivery.

POTASSIUM CHLORATE.—Continental material at 3½d. per lb., ex store.

POTASSIUM PERMANGANATE.—B.P. quality about 7¾d. to 8d. per lb. ex store.

POTASSIUM PRUSSIATE.—Now offered at 1s. 5½d. per lb., ex store.

SODIUM ACETATE.—Moderate inquiry. Offered at £24 per ton, ex store.

SODIUM BICARBONATE.—Refined recrystallised, £10 10s. per ton, ex quay or station; m.w. quality, 30s. per ton less.

SODIUM BICHROMATE.—English makers' price, 4½d. per lb. delivered.

SODIUM CARBONATE.—Soda crystals, £5 5s. to £5 10s. per ton, ex quay or station; alkali, 58%, £8 17s. 6d. per ton, ex station, spot delivery.

SODIUM CAUSTIC.—76/77%, £21 10s. per ton; 70/72%, £19 per ton; 60/62%, broken, £21 5s. per ton; 96/98%, powdered, £24 17s. 6d. per ton, ex station, 4-ton lots.

SODIUM HYPOSULPHITE.—Commercial quality about £10 10s. per ton, ex station; pea crystals, £16 10s. per ton, ex station.

SODIUM NITRITE.—Quoted £27 per ton, basis 100%, f.o.b. U.K. port.

SODIUM PRUSSIATE.—In little request. Quoted 10½d. per lb., ex store.

SODIUM SILICATE, 140°.—In little demand. Price £8 17s. 6d. per ton, ex station.

SODIUM SULPHATE (Saltcake 95%).—Home price on contract, £4 per ton, carriage paid. Higher prices asked for export.

SODIUM SULPHIDE, 60/62% Conc.—Offered from Continent at £14 10s. per ton, c.i.f. U.K.

SULPHUR.—Government surplus stocks of Sicilian thirds at £3 10s. to £3 15s. per ton, ex depot; flowers, £10 per ton; roll, £9 per ton; rock, £8 per ton; ground, £8 per ton. Prices nominal. Slight demand for roll and flowers.

TIN CRYSTALS.—Unchanged at 1s. 2d. per lb.

ZINC CHLORIDE.—English make, £26 per ton, ex station.

NOTE.—The above prices are for bulk business and are not to be taken as applicable to small parcels.

Coal Tar Intermediates and Wood Distillation Products

ALPHA NAPHTHYLAMINE.—Home inquiry. Price quoted, 1s. 7½d. per lb. delivered.

BENZIDINE BASE.—Home inquiries. Price, 6s. 6d. per lb. 100% basis, delivered.

BETA NAPHTHOL.—Home inquiries. Price, 1s. 2d. per lb. delivered.

GAMMA ACID.—Home inquiry. Price quoted, 13s. 6d. per lb. 100% basis, delivered.

"H" ACID.—Home inquiries. Price, 5s. 3d. per lb., 100% basis, delivered.

MONONITROTOLUOL.—Home inquiries. Price, 11d. per lb. delivered, drums extra, returnable.

PARADICHLORBENZOL.—Export inquiries. Offered at £50 per ton, f.o.b., U.K. port.

PARANITRANILINE.—Home inquiries. Price, 3s. per lb. delivered.

PARANITRO ACETANILIDE.—Home inquiry. Price quoted 4s. per lb. delivered.

PARAPHENYLENEDIAMINE BASE.—Home inquiry. Price, 12s. per lb., 100% basis, carriage paid.

SULPHANILIC ACID.—Home inquiries. Price, 1s. 6d. per lb., 100% basis, carriage paid.

Company News

WATER SOFTENERS.—An interim dividend has been declared of 2½ per cent. free of tax.

NOBEL INDUSTRIES, LTD.—The transfer books for the preference shares will be closed from January 17 to January 31 inclusive.

BROKEN HILL SOUTH.—A cabled advice from Melbourne announces the declaration of a dividend at the rate of 1s. 6d. per share, payable on February 16.

DAY AND MARTIN, LTD.—At an extraordinary general meeting to be held on January 18 a resolution will be submitted authorising the directors to dispose of the company's assets to the best advantage.

BRITISH METALS EXTRACTION.—After writing £3,211 off plant, machinery, and stocks on hand, the accounts for the year to May 31 last shows a loss of £8,949, increasing the debit balance carried forward to £74,098.

CORDOBA COPPER CO.—In order to eliminate the debit balance the directors propose to reduce the capital from £200,000 in shares of 5s. each to £80,000 in shares of 2s. each. Provisional arrangements are being made for future capital requirements.

DOMINION TAR AND CHEMICAL CO., LTD.—Announcement is made of an interim dividend of 2½ per cent., free of tax, for the half-year ended December 31 last, payable on January 22. The transfer books will be closed from January 15 to January 22 inclusive.

CANADIAN EXPLOSIVES.—Holders of share warrant coupon No. 47 are notified that a dividend of 1¾ per cent. has been declared for the quarter to December 31 last on the 7 per cent. cumulative preferred shares; the dividend is payable on January 15 to holders on record, December 30 last.

DOMINION GLASS CO.—For the year to September 30 last the net profit was $718,540, which makes available, after deducting interest charges and dividends on the preferred stock, and including $818,144 brought in, $1,184,684. Quarterly dividends amounting to 6 per cent. have been paid and $929,684 is carried forward.

CHAMPION AND SLEE.—An available balance of £3,314 is shown in the accounts for the year to September 30 last. The directors recommend a dividend on the preference shares from July 1 to September 30 last, absorbing £1,050, leaving £2,264 to be carried forward. It is regretted that circumstances do not permit the payment of an ordinary dividend. The annual meeting will be held at the Cannon Street Hotel, London, on January 15 at noon.

SOUTH STAFFORDSHIRE MOND GAS CO.—The company has deposited a Parliamentary Bill for next session, seeking power to issue to the public the £205,000 prior lien debenture stock which was originally sanctioned in 1917 in respect of moneys which were to have been provided by the Minister of Munitions, but which was never advanced by that Ministry. The proposed new stock is to have priority over all mortgages or debenture stock "issued or to be issued" by the company.

ANGLO-PERSIAN OIL CO., LTD.—On Wednesday applications were invited for an issue of 850,000 ordinary shares of £1 each at £3 15s. per share, payable 1s. on application, £1 5s. on allotment (including £1 premium), £1 on February 27 (17s. 6d. premium), and £1 on March 27. The shares now offered will rank for dividend on their full nominal value from January 1, 1923. The subscription lists were closed early on Wednesday morning, but applications received by second post on Thursday were considered.

ALLEN LIVERSIDGE, LTD.—The report for the year to October 31 last shows a net profit, after providing for bad and doubtful debts, depreciation, and all expenses, of £32,696, plus transfer fees, £36, and £3,240 brought in. After providing for interest on loans and debenture stock, directors' fees, etc., there remains £27,075. An interim dividend at the rate of 7 per cent. per annum was paid in August last. The directors now propose that £923 be written off the expenses of the new debenture stock issued and amalgamation, £3,500 written off discount and commission on debenture stock issue, and payment of a final dividend at the rate of 9 per cent. per annum, making 8 per cent. for the year, leaving to be carried forward £4,721. The annual meeting will be held at Caxton Hall, Caxton Street, Westminster, on January 23, at noon.

Chemical Trade Inquiries

The following inquiries, abstracted from the "Board of Trade Journal," have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1. British firms may obtain the names and addresses of the inquirers by applying to the Department (quoting the reference number and country), except where otherwise stated.

LOCALITY OF FIRM OR AGENT.	MATERIAL.	REF. NO.
British India ..	Red and white lead.....	—
Argentina	Perfumery	65

Tariff Changes

AUSTRIA.—As from December 26 last, increased Customs duties are chargeable on, *inter alia*, glucose, laevulose, lactose, mineral and other oils, paraffin wax, petroleum jelly, and perfumery. Particulars of the new rates appeared in the Board of Trade Journal of January 4 (p. 21.)

FRANCE AND ALGERIA.—Modified customs duties increase the rates payable on importation of a small number of chemicals. Among the goods benefiting by reduced duties may be mentioned dextrine, magnesium, chloride and sulphate, lead acetate, and chromates and bichromates of potash and soda. The new "co-efficients" were given in the Board of Trade Journal of January 4 (p. 22.).

UNITED KINGDOM.—A new list of export prohibited goods—save under licence—effective as from January 1 includes a number of explosives, and dangerous drugs. An open general licence has been issued permitting the export to all destinations of Dynobel, Samsonite, and Thames Powder.

London Soapworkers' Strike

THE employees of J. C. and J. Field, Ltd., soap and candle manufacturers, of Lambeth, London, who struck work on January 6 as a protest against a reduction in wages of 4s. per week in the wages of men and 2s. in those of women workers have not yet returned to work. An official of the Distributive Workers' Union stated on Monday that the reductions were decided upon by the employers' side of the Joint Industrial Council for the Soap and Candle Trade without the agreement of the workers' representatives, and that the intention was to impose the reduction generally this week. He added that there was a possibility that the employees of other big firms not only in London but in the provinces would also take action. Everything depended on the attitude of the employers, and they did not yet know whether other firms would make the reduction. If the reduction was imposed all round the area of the trouble was likely to be extended. According to local reports the prospect of a stoppage at Port Sunlight or at Price's Candle Works at Bromborough is regarded as remote.

On Tuesday Mr. Boyd, London secretary of the Distributive Workers' Union, and other officials of the union met in conference the London Employers' Association, when certain proposals were put forward on behalf of the workers, and the employers intimated that they would consult the executive of their national association and communicate again with the union. It is understood that efforts are being made to reach a compromise by a variation of the reduction for London. In the meantime the Lambeth strikers are not returning to work. Mr. Boyd said that the employees of another firm in London were on the verge of a strike, but had continued work temporarily in response to a special appeal to ensure deliveries. They would probably, however, cease work unless there was a settlement.

Yorkshire Oil Merchants' Failure

THE public examination of John Brown and Reginald Hall, trading as Brown and Hall, Hadfield Works, Gelderd Road, Birstall, Yorks, oil and soap merchants, was held on January 4, at the County Court, Dewsbury. According to the statement of affairs there was a deficiency of £308. The debtors attributed their failure to keen competition and heavy expenses. They denied that they had sold goods at less than cost price.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

County Court Judgments

[*NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court judgments against him.*]

BERGIN, — (married woman), 35, Gray's Inn Road, W.C., chemist. (C.C., 13/1/23.) £19 14s. 6d. November 18.

BLUNT, W. H., AND SON, 70, Snow Hill, Birmingham, chemists. (C.C., 13/1/23.) £17 15s. 2d., November 15; and £1 10s. 2d., November 10.

DONALDSON, G. A., 403, Commercial Road, Portsmouth, chemist. (C.C., 13/1/23.) £10 5s. 4d. November 3.

FISHBROOK DYEING CO., LTD., Fishbrook Works, Kearsley, dyers. (C.C., 13/1/23.) £26 4s. November 15.

HALEY, Herbert W., Greenside House, Dalton, Huddersfield, dye merchant. (C.C., 13/1/23.) £16 10s. 4d. November 22.

LINDSAY, — 87, Queens Road, Dalston, druggist. (C.C., 13/1/23.) £13 2s. 1d. November 23.

MORRIS, Ellis Jones, 6, Penrallt Terrace, Llangefni, chemist. (C.C., 13/1/23.) £16 9s. 10d. November 8.

NORRIS BROS., LTD., 107–111, Moorgate Station Chambers, E.C., chemical manufacturers. (C.C., 13/1/23.) £92 5s. 5d. November 21.

SHARPLES, William A. J., 4, Beatrice Road, Hornsey, manufacturing chemist. (C.C., 13/1/23.) £11 9s. 4d. November 17.

STANSFIELD, Mr. J. L., Boothfold, Waterfoot, chemical manufacturer. (C.C., 13/1/23.) £37 8s. 4d. November 24.

STEVENS, Lydia, Mrs., 9, Liverpool Road, Stoke-on-Trent, chemist. (C.C., 13/1/23.) £19 12s. November 20.

STUCKEY, William George, 125, Woodstock Avenue, Golders Green, chemist. (C.C., 13/1/23.) £35 15s. November 16.

TREADGOLD, F., AND SONS, Abbey Dyeworks, Grimsby, dyers and cleaners. (C.C., 13/1/23.) £12 13s. 4d. November 13.

Bill of Sale

MASON, Alfred George, trading as G. H. G. HILL, 319, Kings Road, Chelsea, chemist and druggist. (B.S., 13/1/23.) January 2. £100.

Receivership

SAPON SOAPS, LTD. (R., 13/1/23.) E. Dexter, of 21, Ironmonger Lane, E.C., ceased to act as receiver on December 29, 1922.

Mortgages and Charges

[*NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.*]

EAST MOORS CHEMICAL CO., LTD., Cardiff. (M., 13/1/23.) Registered December 29, £5,000 debentures; general charge. *Nil. July 5, 1922.

HARDMAN (E.), SON AND CO., LTD., Wilmington, tar distillers. (M., 13/1/23.) Registered December 22, mortgage, to bank; charged on Hardmans Works, Bedford Street, Wilmington, with machinery, etc. *Nil. October 25, 1922.

SOUTHDOWN CHEMICAL CO., LTD., Birkenhead. (M., 13/1/23.) Registered December 23, £2,000 sub demise, to G. A. Solly, 55, Hamilton Square, Birkenhead, solicitor; charged on land and premises at Beaufort Road, Birkenhead. *Nil. October 3, 1922.

WYKE DYEING CO., LTD. (M., 13/1/23.) Registered December 23, £3,000 debentures (filed under Sec. 93 (3) of the Companies (Consolidation) Act 1908), present issue £1,500; general charge.

Satisfaction

CROFT (A. J.) AND CO., LTD., Birmingham, metallurgists. (M.S., 13/1/23.) Satisfaction registered January 1; all moneys, etc., registered April 26, 1921.

London Gazette

Company Winding-Up Voluntarily

BAISS BROTHERS AND CO., LTD. (C.W.U.V., 13/1/23.) E. Norton, Thames House, Queen Street Place, London, appointed liquidator.

Bankruptcy Information

ROWLEY, Albert James, lately at Crown Works, Brentford, paint and varnish manufacturer. (R.O., 13/1/23.) Receiving order, January 1. Debtor's petition.

Order Made on Application for Discharge

HIRCHBERG, Leon Maurice, 20, Birchington Road, Stroud Green, and Ely Place, both London, consulting chemist. (O.M.A.D., 13/1/23.) Date of order, October 13, 1922. Discharged on payment of £200.

Partnership Dissolved

LANGTON, FORT AND CO., and THE ALLIANCE DRUG AND CHEMICAL CO. (Lawrence Greville FORT and William Moore LANGTON), wholesale drug merchants, 10, Beer Lane, Great Tower Street, London, E.C., by mutual consent as from December 31, 1922. Debts received or paid by W. M. Langton, who will continue the business.

Edinburgh Gazette

DICKSON (R. B.) AND CO., chemists, 745, Great Eastern Road, Parkhead, Glasgow. First dividend in this sequestration payable at the offices of Thomas Smith and Sons, 135, Buchanan Street, Glasgow, on or after January 29, 1923.

PURVES AND CO., chemists, 25, High Street, Dunbar. Firm dissolved as at December 31, 1922, by mutual consent, by the retiral of James Aitchison Purves. The business will be carried on by George Grant under the old name.

New Companies Registered

FRANK BAILEY, LTD., Beechwood Mills, Shay Lane, Ovenden, near Halifax. Dyers, bleachers, etc. Nominal capital, £10,000 in £1 shares.

CROPPER BROTHERS AND CO., LTD., Hartshead Works, Stalybridge, Cheshire. Manufacturers of and dealers in technical and other tallow, chemical, vegetable or artificial manures, fertilisers, soaps, etc. Nominal capital, £1,500 in £1 shares.

MORRIS AND CO. (STOCKWITH), LTD., West Stockwith, near Doncaster. Electrolytic depositors and chemical manufacturers. Nominal capital, £50,000 in £1 shares (20,000 preference and 30,000 ordinary).

P. AND J. PETER (1922), LTD., 16, Old Burlington Street, W. Manufacturers, importers and exporters of and wholesale and retail dealers in drugs, chemicals, perfumery and soap, etc. Nominal capital, £10,000 in £1 shares.

PORT OF LONDON MERCANTILE CO, LTD. Dealers in wood, tar, creosote, artificial fuels, etc. Nominal capital, £2,000 in £1 shares. A subscriber: M. Cullingford, 50, Galveston Road, East Putney, S.W.15.

PREMIER CLEANSER CO., LTD., 124, Granville Road, Child's Hill, Middlesex. Manufacturers of chemicals, drugs, perfumes, soaps, disinfectants, etc. Nominal capital, £2,100 in 1,600 ordinary shares of £1 each and 10,000 deferred shares of 1s. each.

THE CORPORATION FOR THE ECONOMIC DEVELOPMENT OF TURKEY, LTD., Pinners' Hall, Austin Friars, London, E.C. Manufacturers of chemical products, oil refiners, etc. Nominal capital, £250,000 in £1 shares.

YORKSHIRE ORGANIC NITROGEN CO., LTD., Public Wharf, Belgrave Gate, Leicester. Manufacturers of chemical fertilisers and nitrogenous and other manures, etc. Nominal capital, £10,000 in £1 shares.